SURVIVAL
POPULAR MECHANICS
2016
HOW YOUR WORLD WORKS
It's a scary world out there.
Is Your Family Prepared?
14 Pages of Real-World Advice That Will Keep You Safe
PLUS:
Less apocalyptic, just as useful!
The Man Whose Wife Loves Motorcycles
By Buzz Bissinger
PAGE 60
What to pack
Where to go
How to stay sane
When to eat the dog
PAGE 68
HOW TO RESTORE YOUR OWN FURNITURE
PAGE 45
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POPULAR MECHANICS

CONTENTS

MARCH • 2016

4 From the Editor
6 Calendar
7 The Reader Page
8 Popular Mechanics Everywhere

A BEAUTIFUL THING

10 American Shine Co.'s shoe-shine box: The tool kit for great-looking shoes

HOW YOUR WORLD WORKS

15 How Amazon knows what you want before you do
18 The Interview: The MythBusters say goodbye
22 Small-batch spirits go large scale
24 The ladder that lifts March Madness winners up
26 The work jacket. Now with Kevlar.
28 **Things Come Apart:** 3D printer
30 Great Unknowns

KNOW-HOW

33 The bike that has no off-season
36 Baba Booey (of Howard Stern fame) teaches you to talk to your devices
38 **Tool Test:** String trimmers, hatchets, and vacuum bottles
42 How to crowdfund the right way
44 Shop Notes
45 **Getting Started In:** Furniture restoration
48 Ask Roy

DRIVING

51 McLaren's factory is as immaculate and well crafted as its cars. And it has more carp.
54 **My Ride:** A beloved 1972 BMW 2002
55 Putting car racing into the hands of the masses—legally
56 A lesson in keeping up with routine auto maintenance
58 **Reviews:** The latest from Aston Martin, Mercedes-Benz, and Lexus

▼ NEW COLUMN!

60 Buzz Bissinger becomes a biker

▼ NEW SECTION!

THE LIFE

63 **The Early Anglers**
A weekend in upstate New York in the season's best fly-fishing gear

PROJECT

95 Transforming the family car through paint, patience, and a forgiving wife. By Chad Stokes

POPULAR MECHANICS FOR KIDS

99 Pencils made out of twigs!

STUPID OR AMAZING?

100 Tiny homes

COVER STORY

68

FIGHT OR FLIGHT: A SURVIVAL GUIDE FOR 2016

When things go haywire, you can either stick it out or run for the hills. Here are the skills, gear, and shining examples you need in order to make it either way you go.

PLUS

76

MAROONED IN THE ARCTIC (WITH POLAR BEARS)

After a forced landing into the icy waters of the Arctic Circle, a Russian helicopter pilot could fit his remaining supplies in two hands: a few protein tablets and a half-liter of water. He pulled himself up onto an ice floe, but a polar bear soon joined him. He shouldn't have survived.

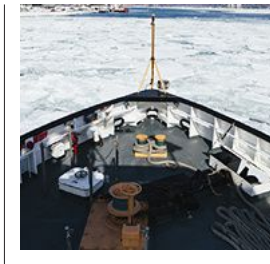
BY JUSTIN NOBEL

82

THE CABIN

When my friend died and I inherited his sawmill, I got the opportunity to mill my own logs to build my own house. And he, in a way, could help.

BY BEN HEWITT



88

THE ICE MEN

Each winter the Great Lakes transform into frozen obstacle courses, threatening a $33.5 billion shipping business. For a small fleet of Coast Guard ships and their crews, clearing the way is as much about outthinking ice as it is outmuscling it.

BY TIM HEFFERNAN

ON THE COVER: Photo illustration for Popular Mechanics by C.J. Burton.

From the Editor

A MEASURE OF CONTROL

I DIDN'T KNOW where to put my woodpile.

This is a strange problem, and one not many people will relate to, and not actually a problem at all. But I'll explain.

This is our third winter in the country after 15 in the city. We bought the house and immediately—before we closed, even—had all kinds of plans. This wall would come down, that table would go there, and the first thing we needed was a deck. But then you spend some time living in the house, and you get to know it, and you learn how to use it. The priorities get rearranged as unexpected needs assert themselves.

For example: The first thing we needed was definitely not a deck. The first thing we needed was working toilets.

Long lists of jobs and tasks and goals have marked every day of these three years. We've done a lot and there is plenty left to do. But where to put the woodpile—that has vexed me. We like to build fires in the fireplace, and in the fire pit in the backyard, and in the chiminea some neighbors gave us for the patio, and soon in the woodstove we're thinking of buying. Wood needs to be stored outdoors, away from the house (woodpiles can draw termites), in a spot where it gets direct sunlight and where the winds can pass through the spaces in between and keep it dry, because you don't want mold and funk in there. The first spot I tried, that inaugural winter, was under a huge maple. Too much shade. For a while now I've stacked it along the back side of the house, but it blocks the outdoor faucet and it's too close to where we park the cars.

> To own a house is to relinquish control. So you really want to nail those rare tasks that are wholly in your hands and bendable to your will.

I've spent hours moving wood around. Which is probably dumb, because it doesn't matter all that much. But you get these things in your head, you know? For some reason, I had to have the perfect woodpile in the perfect location. I can't explain it. Probably because to own a house is to relinquish so much control—you become a servant to wonky pipes, a temperamental furnace, sick shrubs, broken windows. So you really want to nail those rare tasks that are wholly in your hands and bendable to your will. I want my woodpile in the right place. Sometimes I feel like that's all I've got.

I think I've got it now. There's a concrete slab behind the barn, about nine feet square. It gets sun, it gets breeze. It'll do.

RYAN D'AGOSTINO
Editor in Chief

POPULAR MECHANICS
SINCE 1902

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Calendar MARCH

How to get the most out of your month.

SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
28	29	**1** It's Red Cross Month. Honor it by donating money or, you know, blood. Only 10 percent of the population gives.	**2**	**3** Scott's home! After a year above Earth, Scott Kelly will return with the American record for the longest time in space.		
6 Get a head start on your summer garden by germinating and planting seeds inside.	**IN NEXT MONTH'S ISSUE** We go into the field with the world's most daring adventurers. *Plus, there aren't many women in technology. Should we be concerned? An investigation.*		**9** The Geneva International Motor Show takes place this week. Our pals at caranddriver.com will be keeping you updated.	**10**	**11** *Eye in the Sky,* a political thriller featuring drones as weapons of warfare and starring Aaron Paul and Helen Mirren, comes out today.	**12** South by Southwest combines music, movies, and technology in Austin, Texas. You can stream panels and shows at live.sxsw.com.
13 Daylight saving time starts today. Spring forward. You know the drill.	**14** The favorite day of the year for middle school math teachers and interpretive Instagrammers everywhere: Pi Day.	**15** March Madness tips off in Dayton, Ohio. One of the few days you know your bracket won't be busted.	**16** The liquid-fueled rocket (the type used in space travel) turns 90 years old today.	**17** Celebrate St. Patrick's Day with a locally brewed beer, like Bell's Kalamazoo Stout.	**18**	
20 The first day of spring. Start planning your national park trip for late next month, before they get crowded and hot.	**21** Ten years ago Twitter cofounder Jack Dorsey sent the first tweet: "just setting up my twttr," setting the bar pretty low.			**24** Peyton Manning turns 40. Probably feels 80.	**25** If you can get over the idea of Ben Affleck as Batman, go see *Batman v Superman: Dawn of Justice,* out today.	**26**
27 Easter Sunday	**28**	**29**	**30**	**31**		

SUN 3/6

HOW TO PLANT A SEED

Pick up a small bag of germinating mix. The soilless blend ensures that disease and insects won't kill seeds. Moisten the mix with warm water, and distribute, about two or three inches deep, into small containers with drainage holes. Plant the seeds shallow in the container, covering them with a layer of germinating mix that's three times as thick as they are. Place them in a spot that stays a consistent temperature—so away from the hot radiator or cold windowsill—and check daily for sprouts and that the mix is moist.

WED 3/16

THIS MONTH IN MECHANICAL HISTORY

In 1926 in Auburn, Massachusetts, Robert Goddard launched a 10-foot-tall rocket 41 feet into the air for 2.5 seconds using liquid fuel. Military rockets had been used as early as the 13th century, but Goddard's take would eventually put men in space. His choice of liquid fuel over gunpowder allowed the rocket to fly with more precision and efficiency. He continued working on perfecting the rockets until his death in 1945. Today he's considered the father of modern rocket propulsion.

FRI 3/25

A BETTER BATMOBILE

A new, improved Batmobile is part of every Batman flick, including *Batman v Superman.* But unlike previous Batmobiles, which were built on top of real cars (Christopher Nolan's was a Lamborghini), director Zack Snyder created an entirely new vehicle, mostly out of carbon fiber and fiberglass. It's 20 feet long and 12 wide, and uses shaved-down tractor tires as its rear wheels. It has been described as one part car, one part tank, and one part airplane. Whatever it is, it probably lacks sufficient cargo space for a trip to Costco.

The Reader Page

FREE MONEY: We give $100 for reader projects that we publish, and $50 for original reader tips that we run. You can send both to editor@popularmechanics.com.

PROJECT OF THE MONTH

A HEAVY-DUTY PEDAL CAR

When Ray Hulse built this vehicle for his four-year-old grandson, he built it to last. Which explains the body made of solid recycled oak and redwood and the copper and brass bushings. The steering knuckles and wheel are from an old lawn tractor, and the pedal rod is made of iron. Altogether this child's toy weighs more than 100 pounds, which means, unless Hulse's grandson is Paul Bunyan, the toy is heavier than the child. Hulse first got the idea from a newspaper article he came across 30 years ago. At the time he'd planned to build the car for his then-young son, but life got in the way. Last year he decided if he didn't make it now he never would. Using more than 50 years of expertise as a professional builder, Hulse constructed his grandson's car using just a 30-year-old memory of a pedal-car design. Thanks to quality parts and craftsmanship the car actually provides a smooth ride, and its sturdiness means Ray's grandson can pass it down to the next generation.

LETTER OF THE MONTH

Regarding Elliott Woods's story on the Iraqi fighter pilots being trained to fly F-16s in the U.S. ("Baghdad, Arizona," December/January): Iraq is smaller than the state of Texas. ISIS has no aircraft. Why the heck does the Iraq government need a 1,500-mph air-superiority fighter? Instead, they could get six A-10 Warthogs for the price of an F-16. The A-10 is better at ground attack and support, and far less demanding of its pilots. It also has better pilot survivability from ground fire than the F-16.

Jon Kutz
Lake Crystal, Minnesota

Woods responds: *The A-10 Thunderbolt, a.k.a. the Warthog, may have been the better option if the Iraqi Air Force were merely looking to support ground troops in the fight against ISIS. But they also needed to defend their airspace against the threats of neighboring countries, all of which have long-range fighter aircraft. The F-16 was the obvious choice—excelling at high-altitude surveillance, adaptable to many weapons and imaging packages, and capable of air-to-air combat. But there's still another reason why the A-10 wouldn't be the Iraqis' first, second, or even third choice: It's not for sale to foreign militaries.*

YOU'LL HAVE TO REWIRE YOUR HAND SO THAT IT DOES NOTHING BUT SPOON HÄAGEN-DAZS DIRECTLY INTO YOUR MOUTH.

"Popular Mechanics for broken hearts could help me now."

—@Joycelular, via Twitter

TALK TO US!

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POPULAR MECHANICS

EVERYWHERE

What We're Up To Beyond These Pages

YOUTUBE!

» Todd McLellan, above, the photographer and disassembler behind "Things Come Apart" (see page 28), records time-lapse video of each of his meticulous deconstructions. They are mesmerizing displays of the guts of everyday objects, and they're all on our YouTube channel (youtube.com/popmechshow) for your viewing pleasure. Watch this month's edition backward, and see if you can figure out how to put a 3D printer together.

THE PODCASTS!

• Should our survival feature on page 68 get you in the prepper spirit, be sure to download our special survival edition of the *Most Useful Podcast Ever* (available at the iTunes store). Host and senior editor Jacqueline Detwiler helps you make the most out of your post-apocalyptic life—like how to start a fire with your expensive smartphone once cell service (and electric heat) is only a memory. And we'll test out some gear.

• **PLUS!** Check out our other podcast, *How Your World Works,* for deep-dive explanations of life's curiosities. Including how one man spliced together the 70-mm IMAX footage for a *Star Wars: The Force Awakens* screening. Which, yes, we're still excited about. Our podcasts come out on alternating weeks, so you'll always have a new episode cued up.

THE WEBSITE!

SCOTT KELLY COMES HOME

We'll be posting regularly on popularmechanics.com with the fervor of a mission control room as Scott Kelly returns to Earth after a year in space.

INSTAGRAM!

HOW TO SEE WHAT ROY'S WORKING ON

Check our Instagram feed, @popularmechanics, where you might see footage of home editor Roy Berendsohn testing five chipper-shredders at once. And don't forget to show us your own handiwork by using #PopularMechanics.

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NOT FOR YOGA

A BEAUTIFUL THING

Every Man Needs a Shine Box And It Should Be This One

COMPANY: American Shine Co.

LOCATION: Haddonfield, New Jersey

FOUNDED: 2015

All men once wore shoes. Not sneakers. Shoes. Fine leather with intricate broguing. Works of art. And men treated them as such. Sometimes, while waiting for a train or for a barber chair, they indulged in a professional shine. More often they would do it themselves at home. And as they did, their young sons would sit close by, watching, learning about the mysterious business of being a man.

Starting in junior high, Matt Golia would sit in his family's New Jersey living room watching a ball game with his dad, Steve, while they shined. In recent years, they added a little whiskey to the pastime. But it wasn't until a couple of Christmases ago that Matt, now twenty-seven and the owner of some fine shoes himself, finally got his own shine box.

He was not impressed.

"The challenge of shining your shoes is the last part, where you have the cloth and you're trying to get some friction going," Matt says. "It's really awkward to do it by yourself. The standard box has a raised footrest, but that doesn't make it any easier."

So the Golia men headed into the basement shop and got to work. What they managed to produce is a shine box as exquisite as any pair of Italian wing tips—and at less than $200, much more affordable. The pine glows from six rounds of sanding and five coats of lacquer. And the stainless-steel rails—actually, repurposed kitchen-cabinet pulls—are ingenious. Just thread the cloth under and buff with ease, all by yourself. Though of course it's more fun with your father, or your son. And whiskey. *—Sean Manning*

PHOTOGRAPH BY BURCU AVSAR

PAGE 10

ABOUT THE MAKERS

A lifer in the surety-bond business, Steve Golia (above left) dedicates his off-hours to the shine boxes. “Before, he really didn’t have a hobby,” says son Matt, who works for a Manhattan tech startup. “My mom loves it.”

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POPULAR MECHANICS
ESTD 1902

HOW YOUR WORLD WORKS

CAMERAS | LADDERS | MYTHBUSTERS | A JACKET

The Internet Knows What You Did Last Summer

Data analytics is growing more sophisticated by the minute, monitoring your behavior in ways you haven't even thought about. This is fascinating, terrifying—and might save your life.

BY
KEVIN DUPZYK

On the island of forgotten toys that is the average Amazon cart, there are a few certainties. One: You'll leave your mother's birthday gift in there so long you'll end up having to pay for expedited shipping. Two: Amazon knows which items you're likely to buy—and which ones you'll jettison. A couple years ago Amazon was granted a patent for Anticipatory Shipping, a program to predict what products people will purchase before they purchase them. It analyzes shopping history, demographics, and, ominously, "any other suitable source of information" to gain insight into your buying patterns, so Amazon can ship potential buys to a location near you.

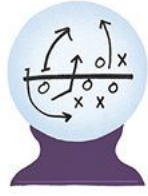
Though Amazon hasn't said how much of the technology outlined in the Anticipatory Shipping patent is already in use, the rapid rollout of superfast shipping options like free same-day delivery and Prime Now one-hour

service suggests the company has already honed its ability to know what you want before you want it. It's just one example of the growing power of data analytics: companies, police, and government agencies mining the ever-expanding digital corpus of information online for data that can, in essence, predict the future. Data analytics (see chart below) has the power to radically alter shopping, medicine, science, and terrorism. It also makes a lot of people vastly uncomfortable.

Kira Radinsky, a computer scientist from Israel who collaborated with Microsoft Research while earning her Ph.D., does research that demonstrates how advantageous data analytics can be: She and her team fed years of articles from *The New York Times,* Wikipedia entries, and other streams of Web data into a computer, after which the computer tried to predict global events like riots and epidemics. In a recent test, news articles from as far back as the 1970s indicated that in countries with high population density and low gross domestic product, drought years followed by floods could trigger outbreaks of cholera. These criteria allowed Radinsky's computer to predict a cholera outbreak in Cuba in 2012—the first in more than 100 years.

The part of data science that unnerves people is not work like Radinsky's—the more help we can get to combat the caprice of truly irrational actors, such as diseases, terrorists, and weather, the better. It's that computers don't understand people. Humans can consider the impact of free will and emotion with a degree of subtlety that computers are not yet capable of. As capabilities outpace regulations, there are sure to be moments in which the thud-headedness of data algorithms leads to problems. Recently, Radinsky and her fellow researchers fed their computer news items

A Few of the More Interesting Things YOU DIDN'T THINK ANYONE KNEW

WHAT	What's going to happen next in this football game.	Which workplace will make you happy.	That you're probably going to quit your job.	Whether you are likely to be a terrorist.	If you are a criminal—or a victim.
					
WHO FIGURED IT OUT	Booz Allen Hamilton	UnitesUs	Workday	Transportation Security Administration	Police departments around the country
THE TECH	**BlitzD, an app that uses game tape to predict NFL play calls.**	**An algorithmic approach that matches job seekers to employers based on more than just skills and previous employment.**	**Software that can tell who is planning to leave a job, and recommends ways to retain unhappy workers.**	**Risk-based security, making the airport-security experience easier for low-risk people.**	**"Predictive policing," the use of algorithms to develop crime hot-spot maps and intercede before crimes happen.**
HOW IT WORKS	Ninety columns' worth of play data, including down, distance, location on field, score, and time, is fed into Microsoft's Azure machine-learning engine. The engine figures out tendencies, then gives a breakdown of the percent chance that the next play will be a run or a pass, to the left, right, or center of the field.	Job seekers upload a résumé, then fill out a personality survey or give the software access to online profiles. IBM Watson's Personality Insights tool uses text from the profiles to develop a personality assessment. If the seeker's skill set and personality match an employee with an opening with more than 50 percent certainty, UnitesUs introduces them.	An algorithm uses more than 100 variables to assign a worker a "retention risk" rating. The software then points out the biggest issues: whether the worker has been in a single position too long, commutes too far, etc. Based on the employer's historical data, the software then suggests the best thing to do to retain the person.	TSA has developed a list of types of people who don't need to be vetted because of their low probability of being a security risk. This includes elderly people, very young people, members of the military, and those who have been qualified ahead of time through the PreCheck program.	There are two kinds of predictive policing: Hot-spot policing involves focusing police in areas where there is a high risk of crime. Cops used to make the maps themselves, but now they can be created algorithmically. At the individual level, police use previous arrests, social networks, and drug use to generate a list of at-risk people.
STATUS	BlitzD was 78 percent accurate at predicting run versus pass during a demonstration using the 2015 Super Bowl, and accuracy is expected to improve with more, higher-quality data. Meanwhile, the NFL is evaluating the fairness of advanced technology on the sidelines.	Up and running since April 2015, it has achieved a 7.5 percent callback rate, compared to less than 5 percent for standard job-search sites.	Retention recommendations are available as of September 2015.	As of June 2015, nearly one million daily travelers have an easier trip through security—but TSA recently failed a variety of security tests and is overhauling its processes.	According to John Hollywood of the Rand Corp., studies have shown a 10 to 20 percent improvement in crime prevention by focusing police on algorithm-derived hot spots. Individual interventions are considered promising, but it is difficult to prove their effectiveness.

ILLUSTRATIONS BY DAVID SENIOR

that they thought would almost certainly trigger follow-up events to see whether the computer could predict them. One such item was the 2010 murder of an Iranian professor in Tehran, Iran. Radinsky's staff, acknowledging the complicated politics of the Middle East, suggested that the teacher's death might trigger protests at his university. The computer's prediction: There would be a funeral.

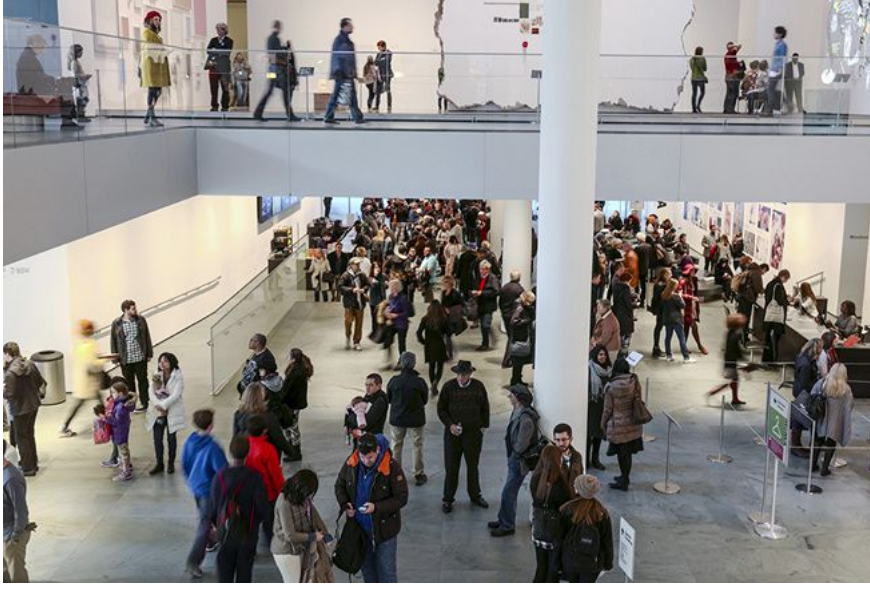
Certainly, these shortcomings are not insurmountable. Data science will continue to improve, and in the meantime, there are efforts to create hybrid systems that combine the capabilities of both big data and human intuition. In Colorado in September, in preparation for a campus visit by the Dalai Lama, law-enforcement officers from the University of Colorado and Boulder County formed a cyber team to monitor social media for tweets, blog posts, or online manifestos that might predict a shooting or other disaster at large campus events.

The group's first attempts at an algorithmic approach were ineffective. Early on, they tried to isolate suspicious individuals by searching for tweets containing the word *bomb*. They uncovered an enormous number of tweets using innocuous slang like "photobomb." Once they refined their search techniques, they still had to figure out how to differentiate a legitimate bomb threat from a disgruntled football fan casually suggesting that a bomb in the stadium might be the only way to keep his team from losing the next game.

THE PART OF DATA SCIENCE THAT UNNERVES PEOPLE IS THAT COMPUTERS DON'T UNDERSTAND THE IMPACT OF FREE WILL AND HUMAN EMOTIONS.

To improve the system's sophistication, they brought in humans. After identifying a suspect based on social media usage, the team treats each case like a police investigation. "We'll look into their other social media," says Sara Pierce, a detective from the Longmont Police Department. "We'll see what other profiles they have, if this is a common topic." It's traditional detective work, using a computer, yes, but also using years of human police experience.

As data science races toward a future in which Amazon will just buy things for us, it will be fascinating to watch computers leap this last hurdle on their own. And they'll have to: Human vicissitudes are what make people prone to crime, rioting, and fickle changes of mind in the first place, and these are the things that we most need computers to help predict. We built computers so that they would understand us, not the other way around. They're getting better at it.



PHOTOGRAPHY

THE CAMERAMAN'S CAMERA

A Pulitzer-winning photographer explains the obsession with Leica by trying out the brand-new $7,500 digital Leica SL, which can fit almost every lens made since 1930.

BY EDWARD KEATING

The first time I learned about Leica was from a legendary camera dealer in New York City. I wanted to see one of his cameras, and he said, "You're not ready yet." All my heroes used a Leica—Cartier-Bresson, Robert Frank. I got my first one in 1982. It's how I learned to be a photographer.

Leica's reputation for being the best you can get is well deserved. It always has the best lenses. The glass is ground to the finest specifications, which means that colors are very, very accurate. The photos don't have the same overbrightness as photos from Japanese cameras. When I set the new Leica SL to high ISO, so the sensor is taking in a lot of light, there's no visual noise or pixelation as on other cameras. The image has a powdery feel. That's something my Canon can't do. It looks like a film photo, but without filters, which never look quite right.

A few weeks ago, I brought the SL to a wedding I was shooting in Uruguay. We were in a car going about 50 mph. I was shooting down the streets, perpendicular to the direction we were moving. I was shocked at how fast it focuses. You click, it focuses, it shoots. It's incredible. It's the best digital camera I've ever used.

Add an adapter to the Leica SL to fit old lenses, which produce subtle, appealing imperfections that make the images look like old photos.

TELEVISION

Goodbye, MythBusters

After filming their final episode, Jamie Hyneman and Adam Savage reflect on the series that redefined science.

BY MATT GOULET

POPULAR MECHANICS: The show's over, and the last episode is airing this month. How does it feel?

ADAM SAVAGE: I can't speak for Jamie, but for me it's been a very intense year. I didn't even work in special effects as long as I've been making *MythBusters*. We did the show for 13 years. I've gone through all the Kübler-Ross stages of grief.

JAMIE HYNEMAN: I don't feel that way so much. It's funny. I'm relieved that it's over. And I'm looking forward to what's next. At the same time, doing something for so long, I've found myself almost tearing up at times when we go out on stage [for the final national tour]. There's something emotional lurking there, but it was time for us to move on.

PM: It's surprising how few things went wrong, except for that cannonball that you shot through a house.

AS: Jamie is fond of saying, "At a certain point you feel like your number's up" when you do s--- as dangerous as what we do. I am so grateful that our number never came up. We have five broken fingers, about 30 or 40 stitches, and one loose cannonball that caused no injuries to our name, and we're both quite proud of that.

That said, I was sure we were gonna have a car accident one day. We do many driving stories in each season, and the part that never shows up on camera is moving the car around. You say, "Okay, 3, 2, 1. Go." Press on the gas and it turns out you're in reverse and you run over a cameraman or a $100,000 high-speed camera. That's the dumbest accident there could be. And yet it's probably the one we were most in danger of having if you looked at actuarial scales.

PM: Even the simplest things can get you.

AS: I'm still terrified every time I fire up the table saw. You use that tool wrong and it lets you know in a hurry. It's very unforgiving.

PM: You guys aren't engineers by trade, right?

AS: Jamie has a degree in Russian linguistics, and I have a high school diploma. But we've both been in the "learn while you earn" program by hosting a television show.

PM: Can handiness be taught?

JH: We've thought a lot about it over the years, in particular because of what's happened to us. Not just in teaching other people, but we have changed dramatically since we started making the show. Having a breadth of experience gives you a foundation to extrapolate solutions to problems with which you have no direct experience. I like to think of it as a stable pile of stuff that gives you a place to put your feet when you reach out and grab new ideas.

PM: Do you think about how much of an impact your show has had on people's assumptions about the world?

JH: What was profound is that it said to people at large that science isn't just for guys in lab coats. It's not some mystical thing that you have to be educated to be able to do. When we showed up on *MythBusters*, we were persistent and methodical about the experiments and, hey, who knew, that's science. Now everybody's going, "You guys are encouraging people to do science." It's more like I'm a bear and I'm s----ing in the woods. Like, that's what I do.

MythBusters Superlatives

Even after 14 seasons and 248 episodes, a few experiments stand out.

▸ MOST DANGEROUS

Inverted Underwater Car

Season 8, episode 19

After showing that you can't open a car door underwater until the pressure has equalized, Savage agrees to try to escape a car that has flipped upside down in a later episode. It proves nearly impossible.

SAVAGE: "This one spooked both of us, for great reason. We knew that there were so many unknowns. We ended up with six levels of safety, and we used five. We would ask: 'Do you still feel wiggy about this one? Let's talk it through.'"

▸ MOST COMPLICATED

Swimming in Syrup

Season 7, episode 6

The MythBusters test whether the added thrust you'd get from swimming through syrup would cancel out the drag from its viscosity.

AS: "Every single day the results we came up with were different than what we thought they would be, so we had to alter the next day's experiments completely. Every day for four days was like that."

▸ MOST LIKELY TO ANNOY A CAR COMPANY

Dirty vs. Clean Car

Season 7, episode 14

Is a dirty or a clean car more fuel efficient? To find out, the MythBusters cover a sedan in 1,082 golf-ball-like dimples.

AS: "One of the Big Three automakers carved dents in a clay model, put it in a wind tunnel, and said they didn't get the same result we did, which I thought was f---ing great. Like we wasted, what, three days of their time and some wind-tunnel hours? That's awesome."

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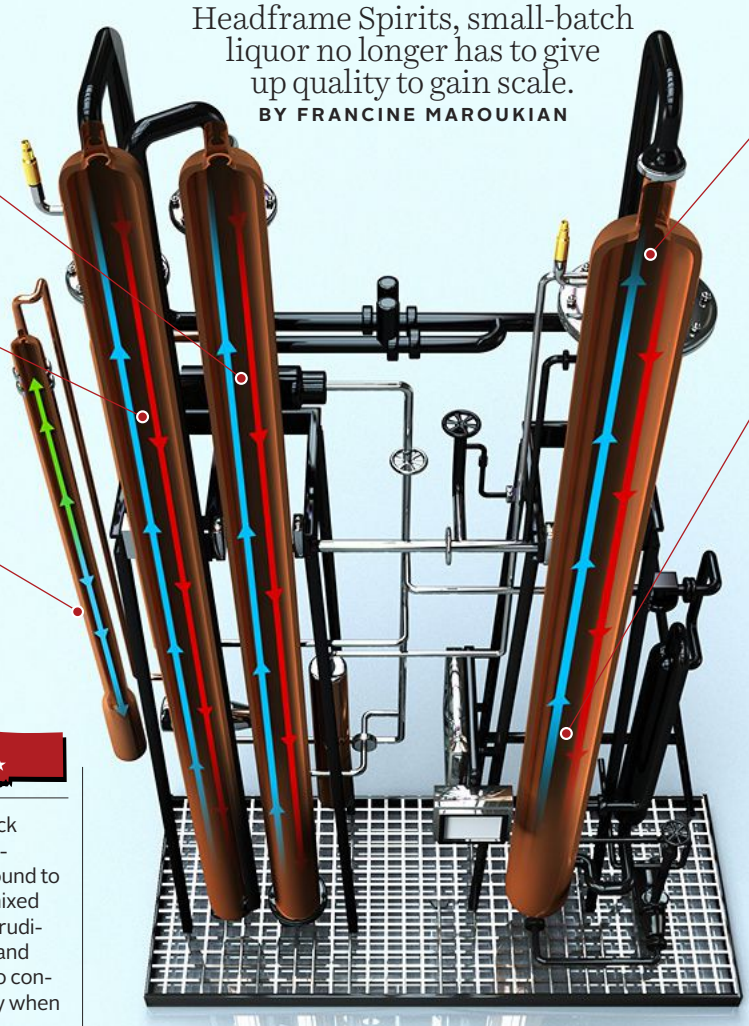
DRINKS

Micro Distilling Goes Macro

Thanks to distilleries like Headframe Spirits, small-batch liquor no longer has to give up quality to gain scale.

BY FRANCINE MAROUKIAN



3 The lower temperature in the second column allows impurities to liquefy and fall to the bottom as the alcohol vapor rises and is transferred to the third column.

4 The process continues, with more impurities falling away in the third column as the alcohol vapor continues to the fourth column.

5 In the fourth column, the purified alcohol ("hearts") condenses, allowing the toxic methanol vapors ("heads") to exit via the top of the system. The alcohol is drained out of the bottom of the still.

1 The fermented liquid created from the mash, called distiller's beer, is pumped into the system at a rate of two gallons per minute. This keeps approximately 40 gallons in the still at any moment.

2 A heat source at the bottom of the column heats the distiller's beer to 212 degrees. The alcohol and water vaporize and rise to the top of the first column, where they are transferred to the second. Any grains or impurities from the distiller's beer (called tails) remain at the bottom of the column and are removed.

ARROW KEY
- Vapor
- Waste
- Methanol

WHY BUTTE?

In Butte, Montana, hard-rock miners used to lower themselves 5,000 feet underground to tap out copper ore. They mixed dangerous handwork with rudimentary mechanics. John and Courtney McKee wanted to continue that innovative legacy when they started Headframe.

WHY HEADFRAME?

The distillery is named after the structure that supports the hoisting pulleys over a mine shaft. Each spirit is named after an historic mine claim. (See right.)

THE BOOZE

Headframe's newest spirit, a single-malt Irish-style whiskey being launched in March, took some experimentation. And science. The McKees reverse-engineered existing spirits using gas chromatography and mass spectrometry to determine their ingredients and how they interact. Then they set about making their own product. "The whiskey has to spend two and a half years in a barrel," McKee says. "We couldn't wait that long to find out if we got it right."

THE INNOVATION

At the craft level, traditional pot distillation is done in batches. As fermented liquid is heated, different parts boil off: first the heads, which can be toxic, followed by the hearts, or principal ingredients, and the tails, or leftovers. The craft is knowing when the heads finish and the tails begin, and keeping only what comes in the middle. It's a time-consuming process. In response, major producers developed continuous distillation, which is more like a series of teapots linked together. Fermented liquid is fed into the system at the same rate that it is boiled off, so it is a rolling process with no need to stop. Those stills "are so expensive and so large we couldn't even make enough mash to turn one on, let alone run it," McKee says. A former biodiesel distillation and renewable-fuel expert, McKee enlisted a few friends from his former career and rescaled the technology (above).

IS IT STILL CRAFT?

For Headframe and any of the other distillers around the country who purchase the company's stills, micro distilling isn't about being tiny. It reflects its attention to detail. "For us," McKee says, "craft is not so much about where you make your cuts. It's about your mash bill (the primary ingredients) and fermenting process. That's where your spirit gets its essential character. Our goal is bringing innovation back to the community. The fewer challenges presented by the distilling process—the fewer possible failure points—the more successful we become."

THE HEADFRAME SPIRITS

NEVERSWEAT BOURBON WHISKEY
Velvety and mellow

ANSELMO GIN
Heavy on the citrus, light on the juniper

DESTROYING ANGEL
100 percent rye white whiskey, earthy with peppery spice, almost like a wheated tequila

ORPHAN GIRL BOURBON CREAM LIQUEUR
Makes an awesome root beer float. Really.

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Duke coach Mike Krzyzewski, a five-time champ, shown last year atop a familiar perch.

UPGRADE

The March Madness Ladder

A Pennsylvania company builds a better way to the top. BY SEAN MANNING

March 8, 1947. North Carolina State has just won the Southern Conference men's basketball tournament. To celebrate, the Wolfpack's second-year head coach Everett Case proposes something strange: He wants to cut down a net. That's what state champs used to do back when Case coached high school in Indiana. A fun idea, but damned if anyone at Duke Indoor Stadium can find a ladder. So Case and his boys simply lift one another up on their shoulders.

That's how the college tradition continued until the mid-1980s, when someone realized a ladder would be more humane after the athletes had spent an hour sprinting and jumping. Since 2008, that ladder, for both the men's and women's NCAA tournaments, has been built by Werner.

This year, the 94-year-old Greenville, Pennsylvania–based company is making the ceremonial snip even easier for players—swapping the traditional ladder for a customized Podium model, whose oversize platform has been enlarged to better suit size-19 high-tops. The guardrail is also elongated and, as on all Werner Podium ladders, features a magnetized "locktop" to secure scissors.

OTHER NOTABLE LADDERS YOU MAY ENCOUNTER

AT HALFTIME SHOWS
A Werner technology called FiberGraphix prints a team's logo directly in a ladder's rail as it's being formed.

WITH RECYCLED PERCUSSION
The acrobatic band prefers Werner's 12-foot twin ladders, so musicians can climb both sides.

FOR GOD
The Immovable Ladder at the Church of the Holy Sepulchre in Jerusalem is considered a symbol of division in Christian history. The ladder has remained in the same spot for more than 200 years because of disagreements among the Christian denominations who claim rights to the historical site. In order to move or alter any property, including the ladder, six Christian sects have to agree.

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THIS MONTH IN WEIRD MATERIALS

Tidal Vision, out of Alaska, is attempting to close the loop on commercial-fishing by-products by purchasing discarded crab shells from sustainable fisheries and extracting chitosan. The fiber—known for its antibacterial, antimicrobial, and antifungal properties—is spun into the yarn of Tidal's moisture-wicking T-shirts, making strange but effective use of the aftermath of your next surf-and-turf night.

FABRIC

The Jacket You Can Beat Up

By adding in the same material that allows flak jackets to stop bullets, one company is giving duck cloth—the sturdy standard-bearer of work-wear fabrics—a marked improvement. BY MATT GOULET

In 1965, a chemist at DuPont named Stephanie Kwolek was searching for a lighter alternative to replace the steel used in reinforcing racing tires. In the lab, she discovered a liquid crystal polyamide that when spun into a fiber was five times stronger than steel at the same weight and lighter than nylon—DuPont's first commercially successful synthetic fiber. The chemical name for Kwolek's compound was poly-paraphenylene terephthalamide. DuPont called it Kevlar.

Since then, it has become synonymous with the tactical bulletproof vests worn by military and SWAT teams, saving thousands of lives since the body armor was introduced in 1975. Kevlar is also found in conveyor belts in coal mines, NASA spacesuits, cellphone cases, motorcycle pants, and hockey socks that can last longer than their smell ought to allow.

And now: the Kevlar work jacket for the man who likes to work. Work jackets have been made largely of traditional cotton duck cloth ever since Carhartt began manufacturing clothes for railroad workers at the end of the 19th century. By weaving Kevlar into the lengthwise threads of its duck cloth, a company called Walls in Fort Worth, Texas, has made a jacket that, while not exactly bulletproof, can withstand the rigors of weekend chores and a construction site alike.

We took a metal file to the elbows of the new Walls Workwear Muscle Back Coat for ten minutes and came away with nothing but minor pilling and a sore arm. Finally, all the hard work you put into breaking in a jacket won't actually break it.

→ Walls built its reputation making coveralls for oil-rig workers. Now it's on to basic work jackets and hunting gear.

POPULAR MECHANICS EDITORS' CHOICE

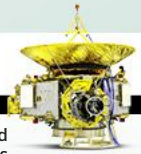
GREAT MOMENTS IN KEVLAR

1973 Canoes made of Kevlar.

1975 The National Institute of Justice sponsors the first field tests of Kevlar-imbued body armor.

1978 Adopted in U.S. Army flak jackets and helmets.

2006 The shield on NASA's Pluto-bound New Horizons probe.



2008 The Ove Glove.

PHOTOGRAPH BY J MUCKLE

TOYOTA
Let's Go Places
WHAT'S NEXT
With modern, striking lines, standard Bi-LED headlights and an uncompromising sense of style, the 2016 Prius has an edge at every angle. Sleek is what's next.
toyota.com/prius
Prototype shown with options. Production model may vary. ©2015 Toyota Motor Sales, U.S.A., Inc.
THE ALL-NEW
PRIUS

DISASSEMBLY REPORT

3D PRINTER

MODEL: 3D SYSTEMS CUBE

PRODUCED: ROCK HILL, SOUTH CAROLINA

TIME TO DISASSEMBLE: 5 HOURS, 17 MINUTES, 47 SECONDS

NUMBER OF PARTS: 677

NOTES: "It seems kind of like magic," began a science segment on the January 30, 1989, episode of *Good Morning America,* "but it's called stereolithography." Onscreen, a machine shoots UV light into a vat of liquid, causing the liquid to harden. Later in the segment, Chuck Hull, the inventor of stereolithography, describes the process as "a three-dimensional printer." Hull founded 3D Systems to create prototypes of industrial parts. Today it also sells a line of hobbyist printers that ditch the vat of liquid in favor of materials that harden as they cool. The Cube from 3D Systems is currently in its third generation, and 3D printing has come a long way too: The Cube is recommended for kids as young as eight.

LOADING THE MATERIALS

The Cube can print designs using two different materials simultaneously. These materials are loaded into the printer in **material cartridges [5]**—one on the left side of the machine and one on the right. Inside each cartridge is a spool of **filament [22].** Hanging off its side is a **print jet tube [17]** ending in a **print jet [20]** and a **nozzle [18].** When a new cartridge is loaded, each tube is fed through a channel between the **front housing [21]** and **rear housing [7]** of the printer, and each nozzle is locked into position in a hole in each **print head [4].**

PREPPING THE PRINTER

Designs can be sent to the printer through a **USB connector [9]** or wirelessly from a computer or smartphone via the **wireless antenna [2]** on the printer's **main control board [1].** First, the printer automatically levels the **print pad [8],** which is attached to the **print platform [11]** by magnets. If the placement requires fine-tuning, the **adjustment knobs [12]** on the platform can be manually twisted until the print pad sits at the appropriate height. Once the pad is level, the user applies a layer of adhesive called **Cube Glue [14]** that will fix the base of the object in place during printing.

PRINTING AN OBJECT

The print jets and the platform perform coordinated movements to lay down hot filament in the precise pattern needed for a given object. Three **stepper motors [10]** move the parts, one for each direction: The print jet moves side to side, and the platform moves both up and down and front to back.

Different filament materials require different temperatures and speeds, so a **printed circuit board [19]** in the cartridges communicates with the printer to tell it what material is being used. The **cartridge motors [6]** feed the filament out of the cartridge accordingly. The filament passes through the print jet tubes and into the print jets, where an aluminum **heating element [3]** heats it to between 210 and 260 degrees Celsius, depending on what material it is, and pushes it through the nozzle and onto the object being made. To clean out material from the previous cartridge that might hang around and contaminate the 3D-printed item, the print head moves to the far left or right and rubs the nozzle against a **wiper [16].** Old filament falls into a **purge bin [15]** in the inner wall of the printer, which must be periodically emptied.

After printing is complete, the user lifts the print pad out of the printer. The printed object will still be glued in place, but after a ten-minute soak in warm water, it can be separated easily with the **scraper [13].** The glue will wash right off.

—Kevin Dupzyk

3D-PRINTING MATERIALS IN ORDER OF STRANGENESS

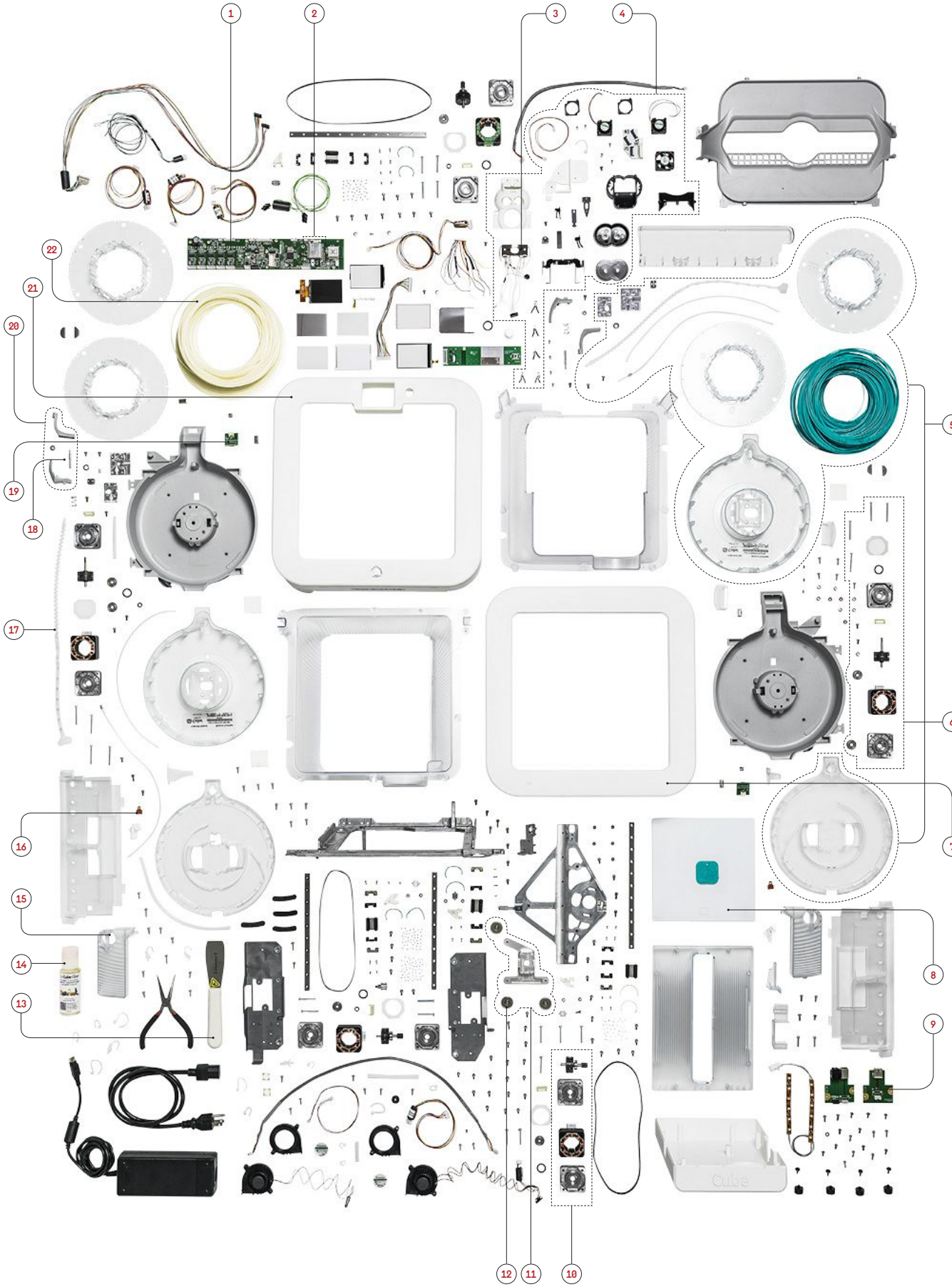
(1) ABS filament

(2) Recycled wood

(3) Spinach paste

(4) Living tissue

(5) Vegemite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GREAT UNKNOWNS

BIG QUESTIONS. ANSWERS YOU CAN'T FIND ON THE INTERNET.

Q In a traffic jam, is it better to constantly move into the lane that seems to be moving fastest, or to pick one and stick with it?

A THIS IS ACTUALLY a bit of a philosophical question, and, as such, each of us must answer it for ourselves. Consider the word *better.* Better for whom? Better how? If you subscribe to the "every man for himself" principle, weave away, baby. Slam that Bimmer back and forth like Iceman's on your six. They don't call you Maverick for nothing. Conversely, if you're the sort who frets over things like shared sacrifice in service of the greater good, pick a lane, any lane, settle in with a fresh bowl of Borkum Riff and enjoy that folk music on your cassette deck.

Anecdotal observation suggests that most of us tend to split the difference—in life as in traffic. As for the latter venue, experts discourage willy-nilly lane-hopping, arguing that any time you might pick up is negligible, while your actions actually slow everybody else down. "When you switch lanes, you're taking up two spaces," observes Henry Liu, a professor at the University of Michigan Transportation Research Institute. "Before you switch, you stay in your lane, you take your space. Then you have to find a space in the other lane so you can switch." Moreover, whipping around from lane to lane increases the risk of a fender bender, which isn't exactly the sort of thing that speeds you on your way. In short, says Liu, "If everyone follows each other and stays in the same lane, we have the highest throughput. It's really for the collective benefit."

But what if it *is* all about you, you selfish so-and-so? The folks from *MythBusters* (see page 18) ran some tests, and their anecdotal results showed that weavers beat the straight-and-narrow crowd over a 46-mile course by margins ranging from two whole, entire minutes to a positively epochal 17 minutes. Is it worth the bother, to say nothing of the bad karma? That's up to you.

How many big oil pipelines are there in the country? How far do they travel?

This one is not a philosophical question. There are precisely 2,687,414 miles of pipeline splayed across the United States like a giant spiderweb. It's harder to say exactly how *many* pipelines there are—certainly several hundred, possibly many more.

The system is a largely invisible (mostly underground) network of pipes of various sizes and functions. Some are two to four inches in diameter. (These would be so-called gathering lines that connect production facilities to larger pipes or, alternatively, "distribution" pipelines that provide natural gas within cities.) Others range from eight to 24 inches ("trunk lines" used for point-to-point transmission of things like gasoline, diesel, jet fuel, crude oil, etc.). Some are even larger than that: The Trans-Alaska system, at 48 inches in diameter, is among the chunkiest trunks in the U.S., and it isn't even attached to a Kardashian.

The longest pipelines run more than 1,000 miles, starting in Canada and terminating at various Gulf Coast and eastern seaports. Notably, no pipeline crosses the country from east to west, which is probably a good thing as it would likely clog with aspiring screenwriters.

Are organic bananas really necessary?

From a health perspective? No, they're not necessarily necessary. It may surprise you to learn that despite the impression fostered by the world's inveterate granola gobblers, tofu touters, and alfalfa advocates, there's no solid science demonstrating that organic produce is any healthier than the regular stuff. "There's never been enough evidence to point either way," says Cathy Deimeke, a dietitian and nutritionist at the Mayo Clinic in Arizona. "It's just not clear." A 2012 Stanford meta-analysis (a kind of study of studies) found no benefit whatsoever, though one British survey did conclude that consuming organic foods could extend one's life—by about three weeks.

In order to be deemed organic by the USDA, produce must be grown in soil that has been free of synthetic fertilizers and pesticides for at least three years. Organic farmers may use only natural fertilizers and must abstain from the use of nasty-type pesticides. Proof aside, that *sounds* healthier, certainly, so if you're fine with spending the extra money the organic label commands, by all means dig in—to your wallet. It can't hurt anything but your bank balance.

Ultimately, though, we sense you may be asking whether the banana peel itself would sufficiently armor the fruit within against a chemical onslaught unleashed by traditional spray-happy growers. Here again the answer may surprise you—no, and here's why: Many modern pesticides are what are called "systemic pesticides," says Kirsten Brandt of the Food Quality and Health Research Group at the U.K.'s Newcastle University. "The general idea is that when you spray these pesticides, they move around inside the plant. They will be on the inside of the banana as much as on the outside." According to Brandt, the chemicals sprayed onto the peel are absorbed through the skin, and those sprayed on the ground would be taken up by the plant's roots. Mere rinsing or peeling of fruit, in other words, won't protect you—assuming there is, in fact, anything against which you actually require or desire protection.

Do you have unusual questions about how things work and why stuff happens? This is the place to ask them. Don't be afraid. Nobody will laugh at you here. Email greatunknowns@popularmechanics.com. Questions will be selected based on quality or at our whim.

ILLUSTRATIONS BY GREG CHRISTMAN

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-Ken

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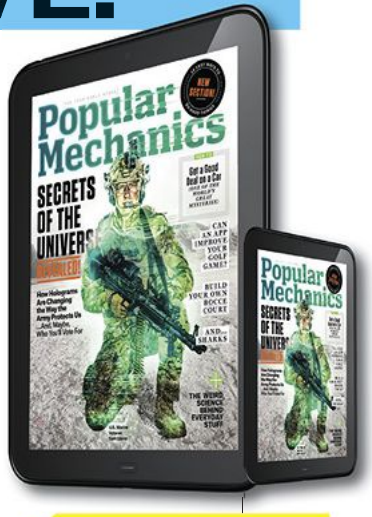

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Thanks to fat, under-inflated tires, biking no longer has an off-season.

BY C. J. CHIVERS

THE WINTER MORNING would hardly seem right for a bike ride. A fresh snow had fallen overnight atop the old, refrozen sheets and piles of snow all around. A chilly wind blew fine, stinging grit. The sidewalks were mostly invisible, the roads an uninviting mix of brown slush and salt. And yet there was my 14-year-old son, Jack, on the walkway beside our shed, checking the tire pressure on a thick-framed black bike. The driveway was to his left. A knee-high bank of snow was to his right. He took his seat, swung the front tire to the right, lunged down on the pedal and crested the snowbank and set off across our snow-covered yard. I followed him, listening to a crust of frozen snow break beneath my weight as my own bicycle moved easily along, across my neighbors' property, down a short but steep snowy hill, and then, with a little jump, past a dock and out onto the surface of a frozen lake.

The access we were experiencing was a triumph of thoughtful design. Aided by a strikingly simple concept—that a bicycle atop soft tires of outsize width will acquire traction on all manner of shifting terrain—we were riding where we had not conceived of riding before. Old hesitations fell away. I remembered a

PHOTOGRAPH BY BEN GOLDSTEIN

mountain-bike trip in the southern California desert a quarter-century before, and veering off a washboard dirt trail at 20 miles an hour, hitting soft sand and having the bicycle abruptly stop, nose jammed in the yielding ground—as I flew over the handlebars in a somersault and landed smack on my back, lucky not to be busted up.

Our adventure with fat-tire bikes began because Jack, a middle school cross-country runner, was suffering from an overuse injury called Osgood-Schlatter disease, a painful inflammation of the tissue where the shins meet the knees that is often related to growth spurts among athletes in their teen years. He wanted to train. But many forms of training—and almost any running at all—caused him more pain. He enjoyed bicycling, but it was December, when opportunities for road and mountain biking narrow with the accumulation of snow.

With the help of Matt Bodziony, the owner of NBX Bikes in Narragansett, Rhode Island, soon we were renting a pair of Trek Farley fat bikes.

It is worth dwelling on the fineness of these bikes, which were superior to any I had ridden before. With disc brakes, smooth-shifting gears, and lightweight aluminum frames, they were swiftly responsive. And their wide tires, ridden at low pressure, gave them a softness over ordinary obstacles (curbs, roots on trails, and the like) that for a cyclist of my modest skill level was beyond the reaches of imagination. This was so even with a hard front fork and an absence of mechanical suspension. It is also worth noting that in the fast-developing fat-bike market, these Farleys marked but a phase. Fat bikes are a growth industry right now—already accounting for 5 percent of the mountain-bike market. Sales in the last year have more than doubled. Demand is so high and sales so brisk that, for a few years, many shops, including Bodziony's, could barely stock them.

There are now many fat-bike manufacturers offering an array of products at different price points. (See opposite.) All of them have brought into the mainstream an idea incubated in Alaska in the 1980s and 1990s, when bike-shop owners and bike designers were trying to bring to adherents of the trail ride a bike that could conquer ice and snow. For years the movement was centered there, and many of the products had a fundamentally local reach.

T. G. Taylor, a former member of the West Point bicycle racing team, told me of being an infantry company commander near Fairbanks in 2002 and discovering that much of the wilderness around him was marsh—impenetrable to mountain bikes in the warmer seasons. Come winter, he bought a rusting Kona mountain-bike frame and took it to a shop owned by Simon Rakower, who had developed a wide rim called the SnowCat. Rakower rigged Taylor's frame for the Alaskan cold, outfitting him with locally conceived rims, tires, and brakes, and Taylor immediately discovered what his Frankenbike fatty actually meant: access. "I was absolutely amazed that I could ride through fluffy white snow and on every single thing that was frozen—frozen rivers, sled-dog trails, everywhere," he said, and then summed up the epiphany that many others have since had: "I could ride."

I followed my son out over the frozen lake. He put his bike into tight turns, kept his balance, and pedaled

The author and his son Jack, out for an afternoon bike ride last winter, outside Providence, Rhode Island.

A WORKOUT ON TWO WHEELS

If a bike is your only method of exercise, here's a good way to put it to use, from **Jay Dicharry**, a physical therapist at REP Lab in Bend, Oregon.

Find Hills

▶ Twice a week, go to the hilliest area you can and conquer it for 45 minutes. If you live in a flat area, crank your gear to a lower setting than you're comfortable with and ride the same 45 minutes, with small breaks. If possible, do it into a headwind. This method, called high-intensity training, gets more muscle fibers active to help build muscle.

Ride Far

▶ Once a week, raise your gear and ride for a longer time—at least an hour. The higher gear will force you to make more pedal revolutions per minute for a more aerobic cardio workout. This is high-cadence training.

Remember Your Core

▶ Buy a bike stand for 20 bucks, then use it to perform single-leg pedal drills. Lift your butt off the seat and roll your tailbone backward. Remove one leg from the pedal and the opposite hand from the handles. Hold for 30 seconds. Switch leg and hand, and repeat. That's one set. Do five sets.

And Your Upper Body

▶ Intense mountain biking does activate the muscles in your upper body but only to a small extent. There is no great way to get an upper-body workout on a bike. You're going to need to do push-ups or find those old dumbbells you still keep in the garage.

ILLUSTRATIONS BY ARTHUR MOUNT

on. Soon he was riding up the steep hill and then down it, jumping out onto the ice for a ride like no other. For him, the very nature of biking had changed. The local bike trails, typically off-limits until plowed, now held the allure of fresh powder, but with a feature uncommon to ski slopes: near solitude.

This meant an opportunity for exercise without inflammation, and in almost any weather at all. A looping ride on the main bike path near our house is roughly 12 miles long and provides (when pedaled hard), a fast, lung-expanding outlet. Jack found when biking that his legs did not suffer, and his baseline fitness could be maintained. Osgood-Schlatter disease can be persistent, however. Like a teenager's growth spurt, it can last a few years. By the time spring came around, Jack was still fit, and he tried tennis, which led to more leg soreness. Fat-bike rides had no such side effect, and so the winter bikes found a life in summer too. By fall, when his running season began again, he was able to keep up with many of his peers, though when he began running again the leg pain returned. (There was a lesson there for my older legs too.)

Truth be told, Jack also would ride sometimes not just for the sake of the ride but also for the buzz of being seen, even after the ice melted and the paths were clear again. Though he owns a fine-looking and very functional mountain bike, I quietly noticed on many a spring and summer day that he would forgo the mountain bike and take out the fattie for short rides to the market or to pick up one of his younger brothers at school or to go to friends' homes. Fat biking, he would say unequivocally, was cool. Once fat bikes achieved that kind of psychic stature—revolutionary in utility, sparkling with style—their popularity was inevitable. "They aren't just snow bikes anymore," Bodziony says. "They are labeled as all-purpose adventure bikes. They are really finding their own as all-around bicycles." What this means is clear: If you have not noticed fat bikes yet among you, you will soon. With time, you will only see more.

But it always comes back to the ride.

On my most recent fat-bike mini adventure, on a Sunday morning in November, I pedaled the bike over a beach parking lot, past a dune fence and the spot where a row of lifeguard chairs stands in summer, and then almost effortlessly across a wide belt of soft sand to the edge of the surf line. The water was cold. The beach was nearly empty. A young couple huddled in a blanket together against a dune looked up from the cuddling with surprise. At the waterline, a group of seagulls squatting and blinking into the chilly breeze grudgingly lifted into flight and squawked in protest as the bike and I came upon them more quickly than they expected—about 17 mph, according to my GPS. This is not very fast, to be sure. The wide tires, the soft sand, the low pressure, and the old body all combine to keep my fat-bike speeds modest. But it is far faster than we have experienced in such places before, and a reminder that, now and then, even among types of equipment that we long thought mature and thoroughly understood, a breakthrough can come, and a new design can update the familiar in marvelous and highly functional ways.

The local bike trails now held the allure of fresh powder, but with a feature uncommon to ski slopes: near solitude.

A Helmet Worthy of Your Brain

BONTRAGER RALLY

▶ The Rally is equipped with MIPS (Multi-directional Impact Protection System), which means the liner and shell are separate, so you have two layers protecting your brain from a fall instead of just one. **$120**

A FAT BIKE FOR EVERY RIDER

A

Felt DD 70

▶ An aluminum frame makes this bike affordable and relatively lightweight. The fork legs are formed with high-pressure fluid instead of heat, which allows for more intricate shaping.

$1,499

B

Surly Pugsley

▶ The original. Surly started the fat-bike explosion in 2005, and most of the bikes made back then are still around. A highly durable bike with mostly off-the-shelf (so, easy to replace) components.

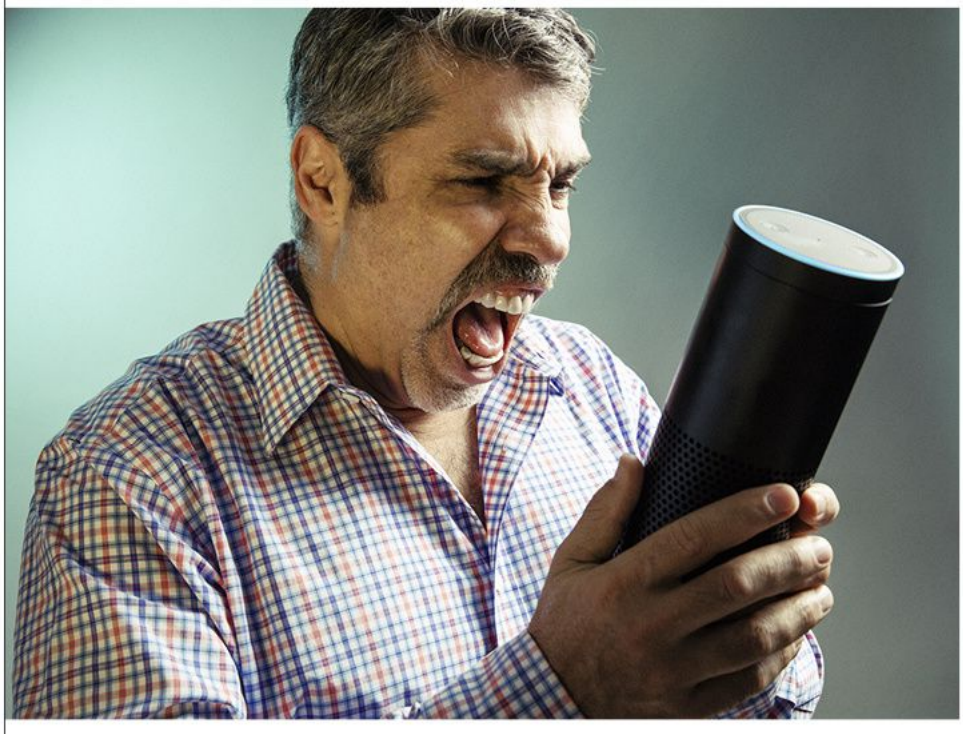
$1,750

C

Farley 9.8

▶ Thanks to its carbon-fiber frame, the Farley experiences less road vibration and weighs less than some traditional mountain bikes. Even with those huge tires.

$4,800



How to Use Voice Recognition

What initially felt like a gimmick—the ability to tell your car, phone, or TV what to do—has become quite useful. And it will only get better.

BY GARY DELL'ABATE

FOR SOME PEOPLE, voice recognition is too weird, too complicated, or just not good enough. I get it. My friend Matthew Berry, a fantasy football guy on ESPN, is in my phone as Berry. My wife's name is Mary. I'll hit the button on the steering wheel in my car to activate voice recognition and say, "Call Mary." "Call Berry?" the car usually responds. "No, call Mary." "Call Berry?" "No!" Now I'm yelling at my car, looking like an idiot to anyone who happens to see me. It's frustrating. The most dialed numbers in my phone are my office, my sons, and my wife. The car should know that.

Considering how amazing the technology is, this is a crazy complaint, but these innovations are so incredible that you just want more. Think about your first flip phone. Compare it with your iPhone now. You were so happy with that flip phone, but if you had to go back, you'd say, "This is archaic!" That's what happens. When there's a really good technology, you become greedy.

Recently, I heard someone compare the current state of voice recognition with the classic video game Pong. Whoever invented Pong never envisioned Call of Duty, but that's what it led to. Voice recognition now is so basic compared with what it will be. But it's already amazing, and it's going to be even more amazing soon. Here's how I use it.

iPhone

▶ On my phone, all I have to do is hit the little microphone on the keyboard to write texts or emails. Saying "I'll be there in 20 minutes" is so much easier than typing. You do have to proofread once in a while, but it saves me a ton of time. The only issue is how self-conscious I get while using it. If someone's in my office and I dictate a text to tell my son "I just put $100 in your account, go buy those shoes," it's weird saying that in front of somebody. It's not that I care that somebody knows. But it's odd to yell your personal information. When possible, I dictate in my car.

Apple TV

▶ The newest Apple TV (32 GB/$149 or 64 GB/$199) has Siri, but not the Siri that we know from our phones. This Siri takes an already invaluable TiVo button—the one that takes you eight seconds back when you press it—and improves it. With Apple TV, you can push the button on the remote and say, "What did he say?" It takes you back 15 seconds, replays the scene, and runs subtitles for those 15 seconds. That's unbelievable. Somebody at Apple really understood what we need.

Amazon Echo

▶ I'm a big, big Mets fan and previously I would get up, bleary-eyed, go to my computer, put in my password, and go to MLB.com. Now, I walk to my kitchen and call out, "Alexa" to activate my Echo speaker (pictured). Then I ask, "Who won the Nationals game last night?" It's brilliant: "The Nationals were beaten by the Los Angeles Dodgers 4–2. They will play again tonight at 10:30." Since you're not staring at a screen as you wait for the answer, you don't notice the time it takes to process your command. I'm usually distracted getting the milk out of the refrigerator.

Alexa has a sense of humor too. Once, just for fun, I said, "Alexa, you're such a b----." She goes, "That's not very nice." I go, "Alexa, I'm sorry," and she goes, "That's okay." Stupid as that exchange may be, it's also frightening. I'm actually starting to have an emotional bond with a machine.

Gary Dell'Abate has been the executive producer of *The Howard Stern Show* since 1984. He can be heard on Sirius XM.

THREE WAYS TO TALK TO YOUR DEVICES BETTER

01
Know their limits
Simpler devices, like voice-activated alarm clocks, only recognize specific programmed commands. "What time is it" may work, but "What is the time" won't.

02
Act natural
Speech apps are trained on actual conversation. If they can't understand you, rephrase the question instead of enunciating or pausing. Between. Each. Word.

03
Check the connection
One bar of service might make a phone call, but it's probably not enough for Siri to turn your voice dial into an action.

PHOTOGRAPH BY STEPHANIE DIANI

Just because you don't see it, doesn't mean it isn't there.

Introducing the newly redesigned Volkswagen Passat with Blind Spot Monitor, one of seven available Driver Assistance features.* Passat. Where family happens.

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When equipped with optional Front Assist

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KNOW-HOW

String Trimmers

It's the indispensable tool for bringing order to overgrown areas and putting a crisp edge where mowers can't reach. For each of these trimmers we cut the lawn's boundary, then walked into a jungle of tall grass, overgrown weeds, and woody stalks.

BY JOSEPH TRUINI

POPULAR MECHANICS EDITORS' CHOICE

Echo GT-225L

★★★★★

RPM 7,500

ENGINE: 21.2 cc
NOISE: 76.8 dBA at idle/ 91.4 at full throttle
WEIGHT: 10.68 lb
LIKES: A lot of trimmer for the money, with more than enough power for residential needs. The machine feels very smooth, thanks to good vibration dampening (the most effective we tested) between the engine and handle, and a cutting head that's mounted on ball bearings. A simple wing nut fastens the front handle, making it easy to adjust for optimal balance.
DISLIKES: Gas cap access is a bit tight.

$200

RPM 7,500

Hitachi CG22EABSLP

★★★★☆

ENGINE: 21.1 cc
NOISE: 83.2/94.2 dBA
WEIGHT: 10.37 lb
LIKES: You immediately notice the Hitachi's weight advantage in how easy it is to handle. It seems to have a bit less power than the other machines, but the Hitachi cuts very effectively and makes up for any shortcomings with great balance and handling.
DISLIKES: Loud.

$205

RPM 8,500

Jonsered GT2228

★★★★½

ENGINE: 28 cc
NOISE: 76.2/93.1 dBA
WEIGHT: 11.12 lb
LIKES: Very powerful. When you turn the machine off, the power switch automatically returns to the run mode, preventing you from flooding the machine by trying to start with the toggle in the stop position.
DISLIKES: Engine vibration needs to be better isolated from the handles.

$160

RPM 10,600

Stihl FS 40C

★★★★½

ENGINE: 27.2 cc
NOISE: 80.1/93.6 dBA
WEIGHT: 10.81 lb
LIKES: The most powerful trimmer we tested. The Stihl mowed down woody stalks and tall weeds without a snag. Its oversize gas cap is easy to remove even in work gloves.
DISLIKES: Front handle and debris shield require a Torx screwdriver to adjust. Black-on-black choke graphics are difficult to read.

$160

TRIMMERS: DEVON JARVIS; HATCHETS: J MUCKLE

Rig-Builder's Hatchets

Drive nails, pound stakes, split wood. All with the same tool.

A

★★★★★

Hardcore Survivalist
LENGTH: 17½ in.
WEIGHT: 1.8 lb
▶ Aptly named, its light weight makes this hatchet ideal for lashing to the outside of your pack on overnight trips. Comes sharp enough to shave with straight from the factory.

$135

B

★★★★★

Estwing E3-R Rigger's Axe
LENGTH: 16¾ in.
WEIGHT: 2.3 lb
▶ Forged from a single block of tool steel, the Estwing is indestructible. Its rubber handle provides a good grip in cold and wet weather or when wearing gloves.

$60

C

★★★★☆

Plumb 11559P Rigster
LENGTH: 18 in.
WEIGHT: 1.8 lb
▶ Has superb workmanship, despite being made in Taiwan. The Plumb's balance gives it an effortlessness that we found perfect for making kindling.

$25

D

★★★★★

Vaughan RB Rig Builders
LENGTH: 18 in.
WEIGHT: 2.2 lb
▶ A superb, American-made tool. The steel sleeve where the handle joins the head provides protection from missed blows, and a taper on the handle makes for an easy swing.

$35

Great Moments in Hatchet History
▶ Humphrey Bogart as down-and-out American Fred Dobbs swings a hatchet while building an oil derrick in Tampico, Mexico, in the 1948 film *The Treasure of the Sierra Madre*.

Heavy-Duty Thermoses

Because cold jobs—and cold hands—deserve warm drinks.

KNOW-HOW

A

Duluth Trading Shotshell 25 oz

★★★★☆

POUR-THROUGH STOPPER: Yes
TEMPERATURE LOSS OVER 10 HOURS: 26 degrees

▶ Shotgun-shell design is amusing. Briefly. Well-made spout and a wide, heavy cup that stays put.

$43

B

Zojirushi Tuff Boy 32 oz

★★★★☆

POUR-THROUGH STOPPER: Yes
TEMPERATURE LOSS: 33 degrees

▶ Pour-through stopper opens with a push button and closes with a slide-stop, but that nice design requires careful cleaning.

$38

C

Thermos Work Series 40 oz

★★★★½

POUR-THROUGH STOPPER: Yes
TEMPERATURE LOSS: 20.5 degrees

▶ Has a useful fold-flat handle and a base with an easy grip. Pour-through stopper is easy to clean.

$37

D

Stanley Classic 45 oz

★★★★☆

POUR-THROUGH STOPPER: Yes
TEMPERATURE LOSS: 35 degrees

▶ Classic, elegant design, with a nice deep cup and a smooth pour. But the stopper takes effort to clean.

$40

E

Isosteel VA-9552Q 25 oz

POPULAR MECHANICS EDITORS' CHOICE

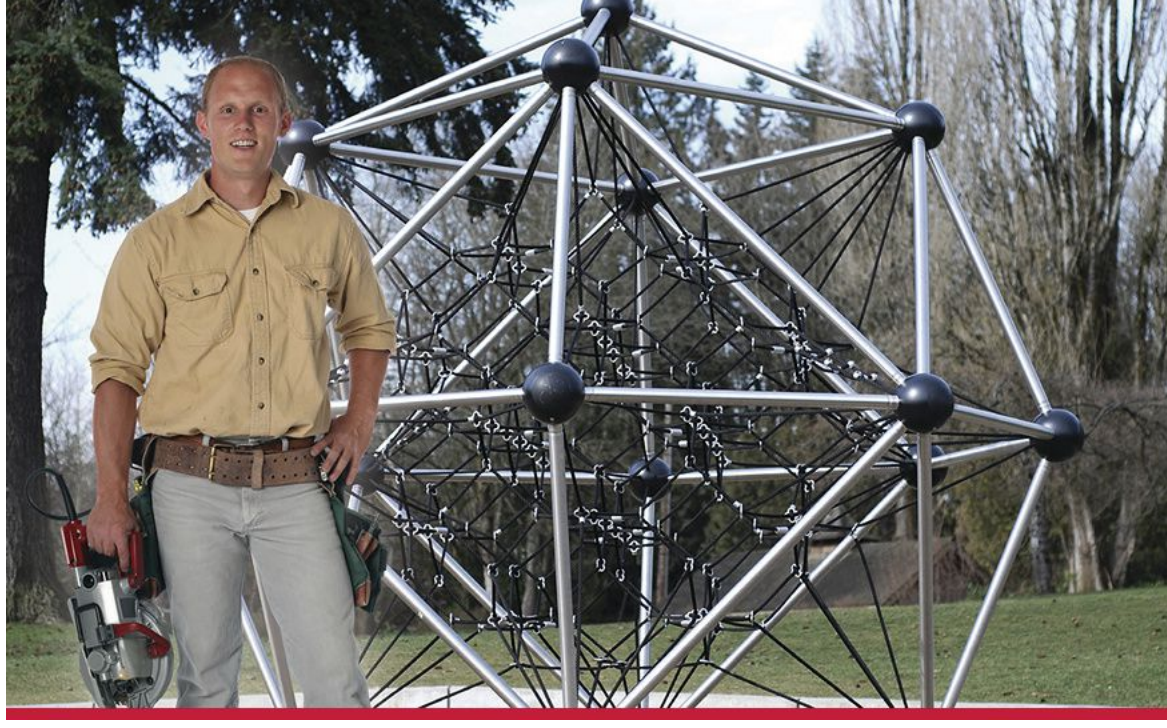
★★★★★

POUR-THROUGH STOPPER: Yes
TEMPERATURE LOSS: 16 degrees

▶ On the small side but compact and well built. Held its temperature best in both 10- and 24-hour tests.

$29

PHOTOGRAPH BY J MUCKLE



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How to Crowdfund

You've got a great idea. All you need to do is pay for it. Better yet, get other people to pay for it.

BRIAN DAVIS WAS WORKING in marketing and sales when he came up with his first product, the Fix It Stick, a portable multitool for bikes. He sketched out the idea and brought it to the owner of a local fix-it shop to ask if he would build a prototype. After fine-tuning the design with a faculty member from a local community college, Davis set up a Kickstarter page. In 30 days he raised more than $30,000. Since then he has successfully launched two more products—a hydration pack that doubles as a water bottle and a protective wind mask for cyclists, which debuted in January. A few of the lessons he's learned about the mysterious and potentially lucrative world of crowdfunding.

Finish the Product First

▶ Before you launch the campaign, be ready for production. That way you'll never miss a deadline for shipping to your backers. For my first Fix It Stick launch, I ordered 100 sets in advance for press samples and testing, then made the rest to order once the campaign was complete.

Set the Right Goal

▶ In many cases, the fundraising goal is arbitrary, as long as you hit the minimum amount needed to create your product or you don't mind investing some of your own money, like I did. For BackBottle, the hydration pack, I needed $12,000 to build a mold for manufacturing. I set my goal at $7,000, and by the end of the campaign I'd raised $20,000. People love seeing that you overshot your goal. Every time I've started a new project since that first one, I've set my campaign goal lower than before. People are impressed when they see that you overshot your goal by 300 percent.

Have a Detailed Plan

▶ I knew exactly what I was going to do at each stage of the process, whether it was before or after the money was raised. I wanted to create social-media accounts, shoot photos and videos, prewrite press releases and Facebook posts. Nothing is too small to plan out, because otherwise you risk missing it entirely.

Don't Forget Shipping

▶ It's easy to overlook packaging and shipping costs, which can get very expensive very quickly. You need to account for those early in the process, or it's easy to go broke.

Embrace the Bloggers

▶ I didn't even try to get coverage from major media outlets right away. I started with smaller bloggers who specialized in cycling, sending them information and samples. (Everyone loves a sample.) Once the product got attention online from that group, it was a lot easier to get press from bigger publications.

Keep Your Job

▶ As long as you have a great product, the money-raising campaign is the easiest part of the process. But even if you are wildly successful at crowdfunding, don't expect it to turn into a career. At least not at first. It's a slow process to make money off the idea. If I were advising me three years ago, I would say to do everything you can to not quit your job.

—As told to Lara Sorokanich

PHOTOGRAPH BY SARA STATHAS

HANDLE YOURSELF WITH CONFIDENCE AND STYLE

ANYWHERE. ANYTIME. WITH ANYONE.

Got a sudden stain on your perfect white dress shirt—just before an important meeting? Need to order a drink for your date? Concerned about how to manscape, buy the perfect gift, leave a dull party gracefully, or navigate the intricacies of any kind of social event? *Esquire's The Biggest Black Book Ever* shows you how to do everything right, in every area of your life.

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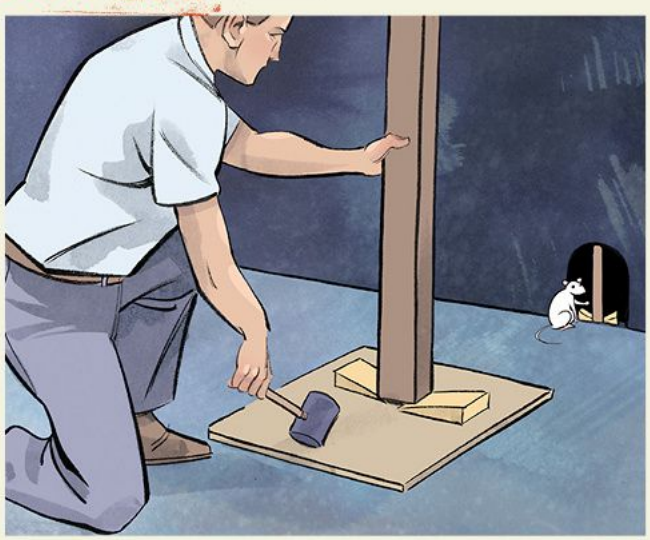
HEARST BOOKS

SHOP NOTES

EASY WAYS TO DO HARD THINGS

KNOW-HOW



A Cheap, Easy, and Clever Alternative to Jacking

RENOVATIONS OFTEN REQUIRE replacing load-bearing posts, which means rigging up a 4 x 4 or a 2 x 8 as a temporary support. If a jack is not readily available, use felling wedges. Cut the temporary support about two inches shorter than the floor-to-ceiling distance. Set it on top of a piece of scrap lumber, which protects the floor and facilitates setting the wedges. Now position wedges on opposite sides of the support and hammer them into place, raising it and the load. For extra security, stop blocks can be screwed into the scrap lumber to keep the wedges in position. When the permanent post has been installed, remove the wedges by tapping them from the side.

FOOD PREP WITH LESS BROWNING

Whether you're packing a lunch or preparing an elaborate meal, it's convenient to cut fruits and vegetables ahead of time. Unfortunately, oxidation—when compounds in the food react with air—turns them brown. Here are some ways to keep food fresh until you're ready to eat.

Apple

Soak the cut apple in a solution of ⅛ teaspoon salt to 1 cup cold water for 10 minutes. When ready to eat, rinse with water to eliminate the salty flavor.

Avocado

After cutting an avocado in half, leave the pit in and coat the surface with olive oil. This seals it from contact with air and complements the flavor.

Potato

After peeling and/or cutting potatoes, submerge them in cold water to limit their contact with air before they're needed. Works best with large cuts.

Pillowcase Cleans Ceiling Fan

Fan blades are dust magnets, and cleaning them is a hassle: Half the dust you wipe off the blades ends up in your face. Swap the feather duster for a pillowcase. Slip the pillowcase over the fan blade, and as you wipe off dust it stays contained.

The Best Tool for Sanding Is a Pencil

When sanding a wood surface, use a pencil to keep track of progress: Draw a line over the surface. Sand until it has been removed. Make heavier marks when working with coarser sandpaper.

Toothpaste Cleans Permanent Marker

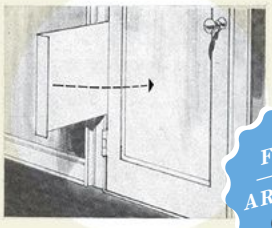
Permanent markers are incredibly useful, until you get a stray mark someplace unintended. Luckily, marks can be removed from many nonporous surfaces with toothpaste. Squeeze a liberal helping of toothpaste on the mark and scrub with water until clean. If the surface is finished or otherwise delicate, test on a discreet area first.

Pipe Insulation Props Paintbrushes

When working a job with a variety of paintbrushes, use a utility knife to cut slots in lengths of pipe insulation, then hook the insulation over the edges of a paint tray. The slits hold the brushes in place, right where you want them.

Decrease Your Odds of Splitting the End of a Board

A sharp nail can split wood. Near the end of a board, the odds increase. To make it less likely, before driving the nail, flip it over and hammer the tip, blunting it slightly. The blunter tip crushes wood fibers, rather than pushing them apart.



FROM THE ARCHIVES (1972!)

Ubiquitous Tool Bends Light Sheet Metal With Ease

Every homeowner has an ideal tool for bending light sheet metal in a pinch: a door. Feed the sheet metal between the jamb and the closed door, in between the hinges. If the door is true, your bend will be too.

Smartphone Aids Reassembly

When performing a complicated disassembly, use your smartphone to record a video of the process. When it's time to reassemble, scrub backward through the video to see the order of operations, and rewatch portions as needed to remind yourself how the parts go back together.

ILLUSTRATIONS BY KAGAN McLEOD

UNEXPECTED INNOVATION

Anyone who saw **Kripa Varanasi**'s 2012 video of ketchup slipping effortlessly from its bottle (without a single tap or shake) knew they were witnessing game-changing coating technology.

Going viral, it resulted in thousands of inquiries before there was even a business—shattering the traditional startup model. And today the product of LiquiGlide™, the MIT professor's company, "is to liquids what the wheel was to transportation."

What inspired LiquiGlide's development?
Originally, we were trying to solve a range of sticky problems (like buildups in oil and gas pipelines) by using liquid-impregnated, slippery surfaces.

What industries will LiquiGlide impact?
While our initial focus was packaged goods, viscous liquids are ubiquitous. So we're exploring the agrochemical, industrial and oil & gas industries.

How flexible is the technology?
It lets us change materials to create a custom slippery surface. Coatings for food products, for example, can be made entirely from food ingredients. (We can even control a liquid's speed.)

What are its green benefits?
LiquiGlide eliminates consumer waste and can mean less rinsing when recycling. And it enables manufacturers to create thicker formulations (reducing packaging and the amount of fuel needed to ship products).

What lessons for everyday life did developing LiquiGlide teach you?
To be a problem solver, innovate out of challenges, and have the entrepreneurial spirit and tenacity to make things happen.

DON'T GO WITH THE FLOW

CHEVROLET MALIBU

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AVOIDING STICKY SITUATIONS
When Varanasi's famous ketchup bottle video went viral, it proved how powerful solving everyday problems could be.

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Getting Started In...

FURNITURE RESTORATION

With a little work, some stain, and a respirator, that old dresser in the basement can earn its way back upstairs. BY KEVIN DUPZYK

QUICK FIXES

Some problems can be resolved without much work.

Water rings

Try gently wiping the area with a cloth dampened in denatured alcohol. Get the cloth just wet enough that any alcohol visible on the surface evaporates immediately. Follow up with a little furniture polish.

Scratches

Liquid products like Old English Scratch Cover and solid products like scratch-cover pens both work well for small, unobtrusive scratches—just be sure to test the color first in an inconspicuous area.

1

Find the Right Piece

You don't want to buy a fixer-upper that's going to cost a fortune to restore, and you don't want to invest time and money in something that was never that great to begin with.

Three Things to Look For

1. According to Mike Kollman of I Like Mike's Mid-Century Modern, a furniture restorer in Brooklyn, New York, the most important aspect of a piece is its "bones." Real wood, not surprisingly, is better than particleboard. Hardwoods clean up more easily than soft. Traditional joints will be easier to work with.

2. Most old furniture is going to have damage, but it's much easier to deal with issues on the sides and legs, where fewer people will notice.

3. A lot of people overlook items with chipped veneer, but this can be easier to repair than it might seem. If you're buying at a garage sale, these pieces are more likely to be undervalued.

TIP! **Legs that have broken across their diameter (as opposed to along their length) are tough to fix properly. They have less surface area for glue to adhere to.**

PHOTOGRAPH BY REED YOUNG

2 Take Care of Major Issues

If the piece has cracks and breaks and will require a lot of gluing, do that first. The mess made by sanding and stripping can interfere with the tight fit required for a good glue job. Otherwise, skip to step 3 and sand the whole thing so you have a bare wood surface for other repairs.

WHAT YOU NEED

MALLET
A light-colored rubber mallet is less likely to damage or mark the surface.

CHISEL
Used to open and clean joints.

RAZOR BLADE
Used to clean out dirty joints. Get something sturdy, closer to a utility knife than a safety razor.

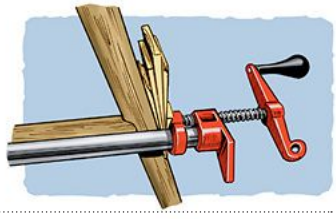
WOOD GLUE
An old standard like Titebond Original is still an all-around great adhesive for most furniture work.

WOOD CLAMPS
Avoid the pistol-grip clamps designed for one-handed operation. They make it hard to get the right amount of pressure.

Cracks

A wobbly leg or major crack can often be treated with wood glue. The key is to clean it out completely. You'll know you got everything when the pieces fit easily together like a puzzle, Kollman says.

1. Gently rebreak the joint or crack with the mallet, so you can get to the surfaces where glue will be applied.
2. Excavate any globs of glue from previous repairs. Small chisels and razor blades are good for getting into nooks and crannies.
3. Clamp the pieces together without adhesive to make sure you can achieve a good fit. If the pieces are curved or oddly shaped, you may need shims or a jig to apply enough pressure with the clamps.



4. Liberally apply wood glue, then clamp. You want to see "squeeze-out"—excess wood glue around the perimeter of the joint. Wipe it off with a damp paper towel.
5. Once the glue is dry, remove the clamp and sand the joint smooth.

Chips and Dents

Chips, dents, and other deformities can be fixed using an epoxy putty like KwikWood.

1. First, use a razor to clear the damaged area of any loose wood or old glue.
2. Next, prepare the epoxy according to the manufacturer's instructions. Then apply it to the furniture as needed.
3. Once it sets, treat it like wood, sanding and refinishing it like the rest of the piece. Beware: Color matching epoxy is a fussy process.

TIP!

Instead of buying parallel clamps, which can run you $200 for a set of common sizes, get pipe clamps. A pair of clamp fixtures costs around $15 and mounts on ½-inch or ¾-inch pipe. With one pair, you can work at many different lengths simply by mounting appropriate lengths of pipe.

Veneer

Veneer, a thin layer of wood glued to a different underlying material, lets furniture look beautiful when it's not practical to build the whole piece from one type of wood. But repairing it can be complicated. Here's what you need to know:

- Make sure to note the thickness of the veneer before you start sanding. On older furniture, the veneer can be thick, but on newer pieces, you can easily sand through it.
- If a gouge or chip in a surface goes through the veneer into the substrate below it, don't even try sanding it out. Fill it with epoxy as you would a dent in the wood.
- Veneer tends to chip around the edges, where something can catch on it. Use a razor to gently check that the veneer isn't loose from the substrate. If it is, glue it down. Then use epoxy putty to fill the chips.

3 Remove the Old Finish

WHAT YOU NEED

SANDPAPER (150-, 180-, 220-grit)

NYLON BRUSH

CHEMICAL STRIPPER

STRIPPER AFTER-WASH

PLASTIC PUTTY KNIFE

TIP!

You're already wearing safety glasses. Instead of adding a dust mask, buy a respirator like 3M's Ultimate FX FF-400. It protects your eyes and lungs at once, and redirects your exhaled breath to limit fog-up.

Oil Finishes

Sandpaper and elbow grease will be better than a chemical stripper. Start with 150-grit sandpaper, and use a sanding block to avoid accidentally rounding square edges. Applying medium pressure, make a few passes, then switch to 180-grit sandpaper and repeat. Work your way to 220-grit, then stay with that until you reach bare wood.

Paint and Other Finishes

Use a chemical stripper and, depending on the type, a stripper after-wash. Apply the stripper with a nylon brush. Follow the instructions on the can to determine how long to let it sit—usually about ten minutes. Scrape off the gunk with a plastic putty knife. (Metal scrapers are more likely to cause damage.) Then apply the stripper after-wash with steel wool. Repeat at least twice.

ILLUSTRATIONS BY STEVE SANFORD

4 Reupholster

Although most reupholstery is best left to professionals, one of the most common upholstery jobs, a dining chair, is quite simple. Here's how to do it.

1

Unscrew the fasteners attaching the seat to the chair body and remove the seat.

2

Flip the seat over. The edges of the fabric are attached with staples. Use a staple remover to remove them or a utility knife to cut the fabric free.

3

Cut a new piece of fabric using the old one as a guide. It should stretch over the seat and its batting (the cushion) with one to two inches of overhang.

4

Add extra batting if necessary.

5

Working front to back, then left to right, staple the overhanging fabric to the bottom. Start in the center of each side. Keep the fabric taut.

6

Reattach the seat to the chair.

5 Refinish

Wait at least 24 hours after stripping and repairs, then it's time to start the finishing process.

WHAT YOU NEED

SANDPAPER
600-grit for deburring,
1,000-grit or finer for finishing

WOOD STAIN

FINISH

The Oil Finish

Using oil finishes means you don't have to work in a perfectly dust-free environment to get professional-quality results.

1. Pour finishing oil on the wood, then spread with a lint-free cotton cloth. Apply excessively—it should look like there's too much.
2. Let sit for 15 to 30 minutes before wiping off any excess.
3. Let dry for 24 hours.
4. Deburr with a very fine sandpaper, at least 600-grit. Clean dust with a lightly dampened cloth.
5. Repeat steps 1 through 4 for at least two coats. If any areas have less of a sheen, put oil on a cloth and gently even out the appearance.
6. Let dry for 72 hours.
7. Use lemon oil and superfine sandpaper of at least 1,000-grit to buff the finish to the desired level of polish.

Other Finishes

A spectrum of difficulty.

EASY

POLYURETHANE
Easy to paint on, but tends to look plasticky. Check that it is compatible with your stain, if you've applied one.

SHELLAC
Dries quickly, which makes it less forgiving when it comes to blotchiness, dripping, and conspicuous brushstrokes.

LACQUER
Unless you have a sprayer, which makes application simple, know that brushed-on lacquer dries slowly and is more susceptible to dust. Also, it smells terrible.

HARD

TIP! Kollman likes customizing the oil finish by leaving a little sawdust from the final sanding on the piece, then applying oil over it. The sawdust affects the tint of the oil and adds some dimensionality to the finish.

STAIN GUIDE

Before finishing wood, it helps to understand a few of its key characteristics. Distinctive colors and grains in woods like teak or walnut are enhanced by an oil finish. If a wood stains poorly—because its grain lets in too little of the stain or accepts stain unevenly—you'll need to sand to a finer grit and use a prestain conditioner.

WOOD	GRAIN	STAINS
Ash	Open	• Well
Birch	Closed	• Poorly (blotches)
Cherry	Closed	• Poorly (low absorption)
Mahogany	Open	• Well
Maple	Closed	• Poorly (blotches)
Oak	Open	• Well
Pine	Closed	• Poorly (blotches)
Walnut	Open	• Well

With additional thanks to Clyde and Sharon Horrocks of Home Furniture Service in Granite Bay, California.

PHOTOGRAPH BY REED YOUNG

ASK ROY

POPULAR MECHANICS' SENIOR HOME EDITOR SOLVES YOUR MOST PRESSING PROBLEMS.

BY ROY BERENDSOHN

KNOW-HOW

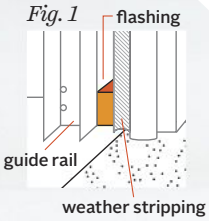
Mice are getting into our house, most likely through the garage. I can't seem to find a way to keep them out. What can I do?

FRANK N., WAUSAU, WISCONSIN

A The garage is the biggest opening into your house, so it's not surprising that that's where mice would go. It's bigger than any window or door, and exponentially larger than some tiny gap around a badly fitting piece of siding. Furthermore, there's often a meal on the other side of the door—pet food, birdseed, even garbage. A mouse would be crazy to try to enter any other way.

Fortunately, the fix is simple. I used it several years ago when mice nearly overran our little neighborhood. Take a trip to a hardware store and buy some aluminum flashing. It's available in small rolls and individual rectangles. Cut each piece to size so it fits between the garage-door guide rail and the weather stripping (Fig. 1). Bend the piece into an L shape that will stand on its own, wedged between the rail and the wall. It should be tall enough that a mouse can't climb over it.

Fig. 1



When you've got these barriers in place, take other precautionary measures: Store animal food in its bag, inside a gnaw-proof container, like the ones made from galvanized steel at behrensmfg.com. If you can, keep this container off the floor. All trash should be stored in tough, tightly sealed cans. Finally, clean and sweep the garage regularly. That way, if the mice do return, you'll be sure to see any signs.

Q We have a sinkhole against the foundation of our house. We've filled it in and it comes back. It's not big enough to be dangerous, but it's ugly. What's the fix?

CHERYL P., ROCKFORD, ILLINOIS

A I suspect you have a high water table (the level to which groundwater rises), and the sump pump stays busy moving a water–dirt mixture away from the foundation in an endless cycle. Furthermore, the gravel surrounding the foundation drain might not be sealed with a geotextile fabric filter. (Homes built as late as the 1960s may have salt hay as a filter over the gravel.) This allows water to wash soil through the gravel and into the sump pit. It's also possible that there's a large gap between two foundation drainpipes, which would permit more groundwater to move through. The gap occurs from sloppy installation, or perhaps one piece of pipe has caved in.

To find the cause, dig down to the foundation drain and investigate. Replace damaged pipe or add a piece of filter fabric to stop the problem.

Q We had a terrible ice dam on our house last year. Could this be due to a problem with our gutters? One guy said that putting a heating cable in the gutter will solve the problem. Will it?

DAVID W., HARTFORD, CONNECTICUT

A No. Gutters do not cause ice dams, and heating cables do not prevent them. The culprit is heat escaping through the attic, roof surface, and eaves. Insulate the attic and ventilate the eaves. By keeping heat inside the house, instead of allowing it to escape through the attic, you keep the roof surface cold. This prevents the freeze–thaw cycle that creates ice dams. (The snow melts on the warm roof, then refreezes when it hits the cold eaves.) It's the only permanent solution to the problem.

Q How early can I put down grass seed?

JACK E., MORGANTOWN, WEST VIRGINIA

A The cool-season grasses that cover most of the continental United States require soil temperatures of about 50 degrees Fahrenheit. You need sustained air temperatures in the 60s to 75 to produce that. Don't start right after temperatures rise, otherwise you risk planting too early. You may have soil temperatures that produce germination, and the seed will sprout, but a frost can kill or damage the seedlings. It's best to check with a nursery in your area for specific advice or contact a state cooperative extension office.

If you live in the south, you can apply grass seed anytime from late spring to early summer when sustained air temperatures reach 75 to 90 degrees. This will produce a soil temperature of about 70 degrees, which is perfect for southern grass species.

☎ Call 212-649-2828 and leave a message with your home or yard question. You could be featured on a new Popular Mechanics podcast. Questions can also be emailed to askroy@popularmechanics.com.

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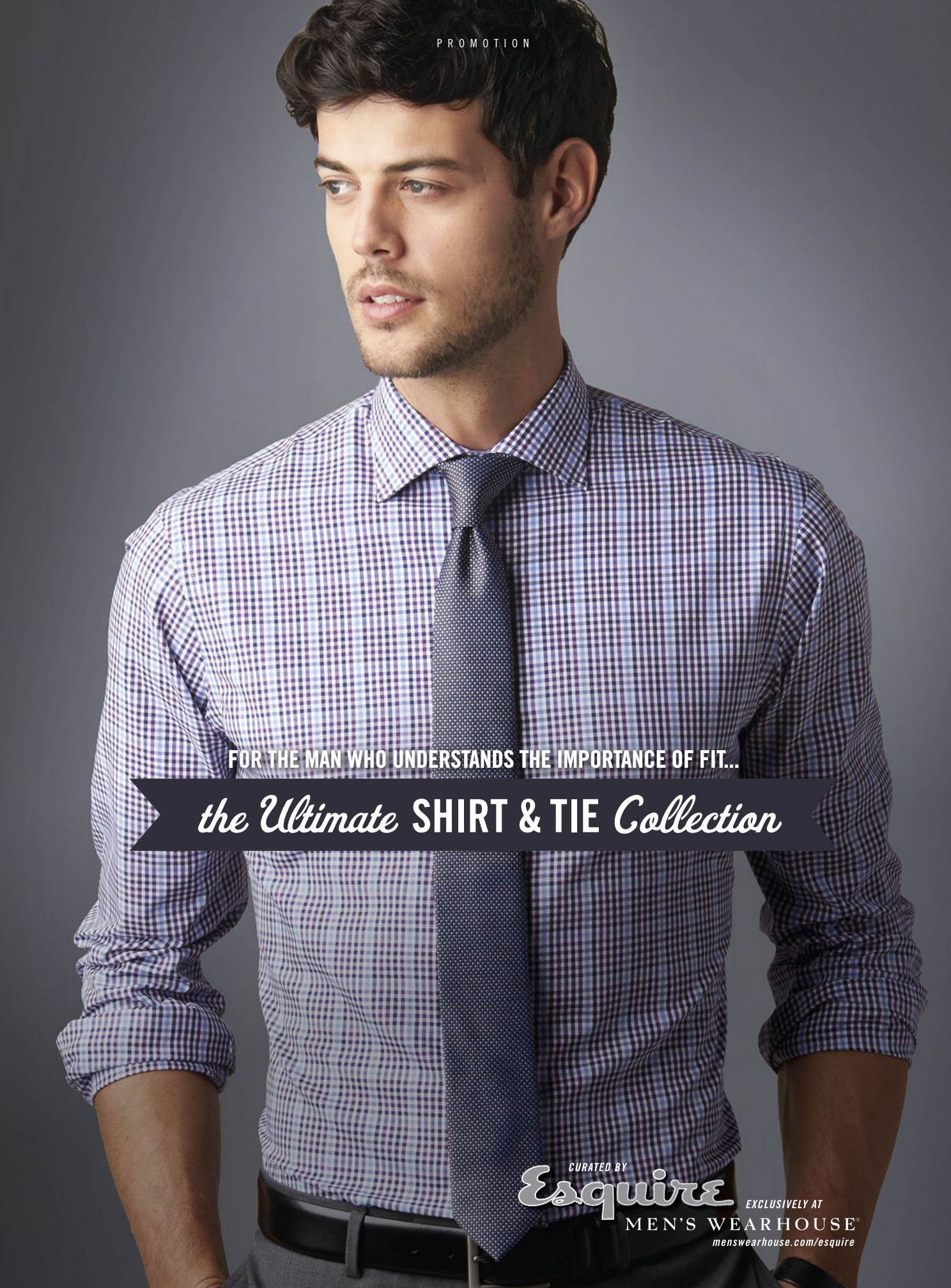
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DRIVING

WITH EZRA DYER

The employee cafeteria at McLaren headquarters is kept at a negative air pressure relative to the rest of the factory, so food smells don't escape.

EXCLUSIVE

Inside McLaren's Automotive Perfectionism

McLAREN ISN'T LIKE OTHER AUTO MANUFACTURERS. I WENT TO THE HEADQUARTERS IN ENGLAND TO UNDERSTAND WHY.

You know you're at McLaren when the trees change. At the roundabout exit for the factory and world headquarters, the forest next to the road isn't like the surrounding countryside. On McLaren property, the trees are in rows, the hedges are square, and the grass has been recently mowed. Order replaces chaos. Before you're even through the gate, you've got a sense of the McLaren worldview, a perspective that accounts for the main criticism of its first real production car, the MP4-12C: It was too perfect. Excessive competence is not a typical problem for startup car companies, but McLaren isn't a typical startup. It's a Formula One race team with decades of history that's learning the road-car business. I wanted to visit while it's still in the ramp-up phase.

A lake flanks walls of glass while the rest of the complex disappears into the hills, modern architecture fused with a Tolkien hobbit hut. Peer into those windows and you see a row of Formula One cars on display in a corridor named the Boulevard. Unlike, say, Ferrari, which has a dedicated program to shill its retired race cars, McLaren still owns every Formula One car it has built since 1980. The Boulevard feels like a morale booster for employees and a delightful surprise for visiting customers. A P1 GTR is the only road car parked here, awaiting its owner's arrival. She would later get the keys to her new hybrid hypercar 100 feet from the 1929 Austin 7 that founder Bruce McLaren raced as a teenager in New Zealand.

I'm greeted by Amanda. Last name: McLaren. She's Bruce's daughter and an ambassador for the company. She doesn't remember much of her father. In

The lake outside dissipates heat generated when McLaren engineers run the wind tunnel to test aerodynamics.

1970, while practicing at the Goodwood Circuit about 40 miles away, he crashed and died. Modern McLaren, the company as we know it, is the product of Ron Dennis, who took over in 1980. Dennis is an autocrat, which is a good thing, because autocrats build the best cars. And he's an interesting brand of autocrat: one who might care about the symmetry of hedges outside his building but doesn't need his name on the building itself.

As a company, McLaren seems to welcome unforeseen problems. Its on-site wind tunnel draws a massive 3 megawatts of power, so the lake outside was designed to function as a giant radiator and dissipate the heat generated while testing aerodynamics. The first year, though, the warm water attracted mayflies that bred and filled the lake with writhing larvae. McLaren researched fish that could tolerate wide temperature swings. Now, carp eat the insects and keep the water clean.

Behind the Boulevard, windows look in on an immaculate workshop where green lasers flit over what look like carbon-fiber coffins. "Those are Formula One cars," Amanda says, "next year's tubs." The lasers are counting the layers of carbon fiber and recording the assembly progress of each one. She leads me down a white hallway. "Before I came here, I was a registered nurse," she says. "And these halls are cleaner than some of the surgical rooms I've been in." She opens a door, and after we walk through, I reach back to pull it closed, but it doesn't move. "That'll take care of itself," she says.

We enter the production center from the second floor and are confronted with a sprawling, factory-foreman view of car building. The operation lacks an assumed element of the modern car factory: robots. Unlike robots, "People can do multiple jobs," Amanda says. "They can spot flaws." Producing only 4,000 cars a year, and subcontracting the engine and gearbox assembly, this facility can get away with that. Besides, in the supercar realm, there's a degree of art involved. At the paint examination station, technicians identify exterior blemishes that, even after they've been marked with tape, are invisible to my untrained eye.

Completed cars go to a dynamometer to assess the powertrains, but McLaren's dyno is, of course, different. When testing a rear-drive car like a McLaren, typical dynos keep the non-running wheels locked. But McLaren's machine has powered rollers under the front wheels so engineers can test traction control and other systems that draw data from the front wheels' speed sensors. McLaren goes deeper.

That means that by the time you drive a McLaren, a lot of people have spent a lot of time making sure it all works. Back in 2010 when I drove a 12C for the first time, a representative emphasized that the stereo's FM tuner needed improvement.

The brand's early missteps in selling to consumers weren't due to performance or quality so much as to marketing. McLaren added new models so rapidly—the 12C gave way to a more powerful 12C, then a 650S, then a 675LT—that its early customers got aggravated. The company seemed genuinely surprised by the fact that nobody wanted a 12C once it introduced the superior 650S.

McLaren is still trying to understand the psychological profile of its audience. Like Tesla, McLaren has no use for traditional product cycles or ensuring that you've got a four-year guarantee that the valet will park your car out front. McLaren is accustomed to a different sort of timetable. The kind with two-second pit stops.

Perhaps, as the years go by, McLaren will learn to behave like a normal car company instead of like an F1 team holed up in an underground spaceship. But I hope not.

FORMULA ONE HUMOR

In 1993, video-game-maker Sega was flush with profits from its hit game, Sonic the Hedgehog, and every F1 team was gunning for Sega sponsorship money. McLaren didn't get it, and that year, McLaren's driver Ayrton Senna drove an MP4/8, running a Ford engine that reportedly had 80 less horsepower than his Sega-sponsored rivals. But, being Ayrton Senna, he won five races. After, he had a decal put on his car: a hedgehog plastered with tire tracks.

THE ENTRY-LEVEL McLAREN

The 570S's doors are dihedral, meaning that they swing up and forward, a rare move in the under-$200,000 realm. McLaren cut some of the 650S's more expensive hardware (bye-bye hydraulic antiroll suspension), but they were smart enough to keep the rad doors.

Fancy features aside, the 570S retains the key components that define a McLaren. It's got a high-revving 3.8-liter turbocharged V-8, seven-speed dual-clutch transaxle, and carbon-fiber tub, same as its big siblings. There's less power than the 650S but also lower weight. The 570S weighs as little as 2,895 pounds, only 70 pounds more than a Mini Cooper S automatic. Lower weight, less money—at $184,900, this is now the least expensive McLaren you can buy in the U.S.—and it still feels crushingly quick. If you don't need to have the biggest number on the badge, this is the McLaren to dream about.

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MY RIDE

1972 BMW 2002

OWNER:
Mike Villa

LOCATION:
Santa Ana, California

YEARS OWNED:
Two

I WAS DOING VIDEO production for a magazine, and I got to drive a lot of the new BMWs. I remember coming away so unimpressed. They're extremely comfortable, but it's sensory deprivation. There's just no feedback in the electric steering, and they feel like bigger overall cars than five, ten years ago. To be fair, you could say that about nearly any manufacturer now. That got me looking into older BMWs, then older and older BMWs.

I found mine on Craigslist in San Diego. The owner clearly never had a large budget and wasn't terribly concerned with doing things the right way. Later I found out that the shift linkage was made out of rebar welded to a MagLite flashlight. I didn't love that particular car, but the expensive stuff on it, especially bodywork, seemed to be in order.

Since then, it's never stranded me, and I've never had to call a tow truck. I just change the oil and make sure it's never sitting for a long period of time.

One day, I thought it would be nice if it were more quiet. Installing sound deadening doesn't take a lot of skill, just a lot of time. But I live in an apartment complex and it's my daily driver, so even if I wasn't done, I'd have to put it back together. I'd take out all the seats, the center console, rip out the carpet, put everything back. Take it all out again, rip out the old sound deadening, put everything back in. I drove around with a bare metal interior for a couple of weeks before putting in the first layer of sound deadening. It's a lot of work, but if it's something I feel I can tackle myself, or something that I want to learn, I go for it.

PHOTOGRAPH BY JONATHAN MICHAEL CASTILLO

Equal Opportunity Auto Racing

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So you want to go racing? You'll need a car, spare parts, a fire suit, and a helmet. Then you'll need to find a race series, a league, most of which only allow expensive cars. Then you need to transport everything to the track, which might be on the other side of the continent. It'll be deep into six figures, but it's better if you can spend an even million.

Or…you can just show up and drive. That's the promise of something called arrive-and-drive racing: Pay a flat fee, get in a real race car, and go wheel to wheel for first place. When you're done, you go home.

Arrive-and-drive is popular in Europe. For around $9,000, you can drive a loaner Audi RS4 in the 24 Hours of Nürburgring or an Aston Martin in the GT4 Challenge. So it figures that EXR Racing Series, a new business based in Las Vegas and Los Angeles, was founded by two Frenchmen, race driver Romain Thievin and investment banker David Perisset. EXR provides the cars and the tracks and takes care of every detail, from postrace data analysis to finding a pair of foot-hugging Pilotis in your size. The base price for a race is $4,990 plus $990 for the mandatory insurance. Whether or not that sounds expensive depends on your race-car frame of reference. For instance, Mazda estimates that *after* you've bought its new MX-5 Cup Car (below), a race weekend will run you about $7,000 for tires, transportation, and a hotel room. (Though you might be able to get through it for slightly less if you embrace camping and a diet of Hamburger Helper.) For the experience of swapping paint and executing that pass low into turn three, EXR is a pretty good deal.

But if a business is going to host its own races, it needs a real race car. The EXR LV02 is not just a modified road car, but a proper tube-frame racer, all flared fenders and a big spoiler with a bare, purposeful interior. The car weighs only 1,653 pounds and uses a 230-hp Renault engine driving the rear wheels through a sequential manual gearbox controlled by the steering wheel shift paddles. The only reminder that you're not a Le Mans champion is the driver's-ed brake pedal in front of the passenger seat. Which, in my case, will be occupied by Alexandre Prémat, a French race driver who's run Le Mans and, most recently, the Australian V8 Supercars series.

The 1.2-mile Los Angeles sprint track is a road course laid out on a glassy sea of pavement. It's a huge parking-lot autocross course, but with proper corner curbing as at a dedicated track. I roll out with Prémat and get acclimated. It's bang-bang-bang up and down the gears while, over the helmet radio, Prémat keeps telling me to ramp up the pace. I keep pushing but, eventually, I get messy, sliding around and screwing my lap times. We take a break to reflect.

My inner ear is calibrated to street-legal machinery, and the LV02 is a race car. At speeds where a civilian Alfa Romeo 4C would be deep into a tire-killing slide, the LV02 is glued down. My second time out, I get better, shaving time off my previous laps. I'd improved, and that's what counts.

That day wasn't completely representative of what EXR sells because I didn't compete against anything except my own ego. When it's a fender-to-fender competition, adrenaline is flowing and you're glad for that mandatory insurance. But in the most important way, my time with the LV02 was completely realistic. When I pulled back into the pits after the final lap, I didn't start loading a trailer. I got in my rental car and drove back to my hotel. That's the reason anyone who dreams of chasing the checkered flag in a real race should pay $5,890 for this experience. You're not just paying to get into a race car and overtake the guy in front of you. You're paying to leave it all behind when you're done, fond memories untainted by the realities of storage charges or a blown rear differential. And that, ultimately, is the best part about arrive-and-drive: the departure.

A RACE CAR YOU CAN BUY

➔ **If you want to buy** a factory race car that has a series in which you can actually compete, the options tend to be crushingly expensive: Ferrari Challenge, Porsche 911 GT3, Lamborghini Blancpain Super Trofeo. Or you can buy a **2016 Global Miata MX-5 Cup Car** and race it in up to 12 events each season. Built in North Carolina, the $53,000 MX-5 Cup is a Miata that's been redesigned as a race machine, complete with a roll cage, a fire-suppression system, and beefed-up cooling, brakes, and suspension. But the key parts are sealed with tamperproof stickers, so you can't spend money on performance parts. That way, talent is the only variable on race day. Want to spend money on something? Spend it on driving lessons.

Don't Ignore Your Brakes

PARTS & SERVICE DEPT.

A STORY OF MECHANICAL NEGLECT FROM THE ONE GUY WHO SHOULD KNOW BETTER.

A guy, let's call him me, decides to buy a solar array for his home. The solar technician tells me, you gotta get rid of those two trees because they shade the roof where the panels will go. I call the tree guy, who comes to take a look. The tree guy says he needs to get a bucket truck into the yard to take out the trees, and to make it fit, he'd need to remove a section of my fence. But next to the fence sits an unforeseen obstacle to glorious, renewable solar power: my boat trailer.

As you've probably seen on cars, iron brake rotors rust. But then you start driving, and every tap of the brake pedal scours the rotors clean. Motion keeps brakes healthy, and knowing that, I'd intended to move the trailer once every couple of months, ideally by actually using the damn boat. But you know how that goes. The boat and its trailer sat for three months, then four, the axle's rotors and calipers calcifying into an oxidized mass. Now I had to move it and couldn't. Slacking on maintenance had made it inconveniently clear how disparate machines are interconnected.

If you're not using it, lift it

● What I should've done is put the trailer on blocks to take the weight off the tires. Then I'd give the brakes a bath in anticorrosion spray. When the trailer is lifted, even spinning the wheels like a *Price Is Right* contestant helps. But I didn't do any of that. I left my trailer on its own, and it developed a grudge. One that threatened to postpone my magnificent renewable-energy future.

Keep them dry

● The trailer wasn't the problem, really. Just its brakes. Trailers, simple as they are, require upkeep—bearings greased, tires rotated, electric connections cleaned. And trailers with disc brakes (like mine) add another level of fiendishness. Rusted rotors can completely lock the wheels, a problem I exacerbated when I, with good intentions, put tire covers on the wheels to protect them from UV degradation. The covers' lining, however, wicked water off the ground, making everything inside even wetter.

Get mechanical assistance

● Getting solar panels meant reversing the damage. I jacked up one of the trailer wheels to open it up and assess the situation. But I'd never tended to the lug nuts. One now appeared to be welded to the stud, the screw that holds the tire. I eventually muscled it off, destroying the stud in the process and revealing a rotor that had the color and texture of a meat-lover's pizza. I actually felt sorry for it.

I doused both rotors in Liquid Wrench, repeated the process on the other side, and hoped that sheer force would convince the brakes to function. I hitched the trailer to my Bronco, and crawled across my driveway for ten feet, front wheels locked and dragging through the gravel. Then the weight of the boat coaxed the left caliper to release. A few feet later, the right wheels broke free. We were in business. I drove down the road, stopping hard to grind the crud off the rotors.

I kept driving, all the way to the boat dealership. The outboard motor needed its three-year maintenance, and I wasn't going to wait.

THE RESOURCEFUL CAR OWNER

HOW TO THAW A FROZEN LOCK

➔ **When I was** in college, I took out a loan to buy a Lamborghini and start an exotic-car-rental company. We later got a Ferrari 360 Spider in the fleet, and one morning, after a night when the temperature dipped below 20 degrees, I got to the garage where I'd left it, planning to drive it back to our warehouse. When I hit the unlock button on the key fob, I could hear the locks straining to rotate, but the doors wouldn't unlock. The car also had this security feature where both doors had to unlock before either one would open, which meant I couldn't use a physical key to muscle my way in. I called the local dealer. They had no idea that the locks could even freeze. I called a Ferrari dealer in Canada. They told me to pull back the weather stripping at the base of the window and pour steaming hot water into the body of the door around the lock. Knowing that Italian electronics could be volatile, I was terrified to do it, but waiting for the temperature to climb meant getting towed. I found a coffee machine nearby and got some water. I pulled back the rubber and poured, then waited a few seconds. I clicked the key fob, and it actually worked. The doors unlocked and I got the car back to the warehouse.

—Ed Bolian, sales director at Lamborghini Atlanta and record holder for fastest cross-country drive (28 hours, 50 minutes, 26 seconds; set in October 2013)

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Limit 1 coupon per customer per day. Save 20% on any 1 item purchased. *Cannot be used with other discount, coupon or any of the following items or brands: Inside Track Club membership, extended service plan, gift card, open box item, 3 day parking lot sale item, compressors, floor jacks, saw mills, storage cabinets, chests or carts, trailers, trenchers, welders, Admiral, CoverPro, Daytona, Diablo, Franklin, Hercules, Holt, Jupiter, Predator, Stik-Tek, StormCat, Union, Vanguard, Viking. Not valid on prior purchases. Non-transferable. Original coupon must be presented. Valid through 6/9/16.

11138915

SUPER COUPON

FREE WITH ANY PURCHASE

PITTSBURGH 1" x 25 FT. TAPE MEASURE

LOT 69031/69030 shown

$4.97 VALUE

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11143552

WOW SUPER COUPON

RAPID PUMP® 1.5 TON ALUMINUM RACING JACK

PITTSBURGH AUTOMOTIVE

- 3-1/2 Pumps Lifts Most Vehicles
- Weighs 32 lbs.

SAVE $60

Customer Rating

LOT 69252 68053/62160 62496/62516 60569 shown

$59.99 ~~$89.99~~

comp at $119.99

11120552

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SUPER COUPON

60 LED SOLAR SECURITY LIGHT

SAVE 54%

Bunker Hill Security

LOT 62534 69643 shown

Customer Rating

Includes 6V, 900 mAh NiCd battery pack.

$31.99 comp at $69.99

11142992

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SUPER COUPON

7 FT. 4" x 9 FT. 6" ALL PURPOSE WEATHER RESISTANT TARP

SAVE 57%

HFT

LOT 69115/69137 69249/69129/69121 877 shown

Customer Rating

$3.99 comp at $9.38

11117115

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WOW SUPER COUPON

8750 PEAK/7000 RUNNING WATTS 13 HP (420 CC) GAS GENERATORS

PREDATOR GENERATORS

SUPER QUIET

Customer Rating

LOT 68530/63085 63086/69671 shown

LOT 68525/69677 63087/63088 CALIFORNIA ONLY

- 76 dB Noise Level

SAVE $459

$540 ~~$599.99~~ comp at $999

11129420

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SUPER COUPON

ELECTRIC CHAIN SAW SHARPENER

CHICAGO ELECTRIC POWER TOOLS

4-1/4" grinding wheel included.

Customer Rating

SAVE 40%

LOT 61613/68221 shown

$29.99 comp at $49.99

11131381

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SUPER COUPON

TORQUE WRENCHES

PITTSBURGH PRO

- Accuracy within ±4%

Customer Rating

SAVE 60%

YOUR CHOICE $11.99 comp at $29.99

DRIVE	LOT
1/4"	2696/61277
3/8"	807/61276
1/2"	62431/239

Item 239 shown

11136321

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SUPER COUPON

US GENERAL PRO

25" 16 DRAWER ROLLER CABINET

- 1060 lb. capacity
- 14,600 cu. in. of storage

Customer Rating

LOT 61609 67831 shown

SAVE $633

$319.99 comp at $952.99

11124207

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SUPER COUPON

BADLAND

SAVE $200

2500 LB. ELECTRIC WINCH WITH WIRELESS REMOTE CONTROL

Customer Rating

$59.99 comp at $259.99

LOT 61258 shown 61840/61297/68146

11123354

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SUPER COUPON

1500 WATT DUAL TEMPERATURE HEAT GUN (572°/1112°)

drillmaster

LOT 62340/62546/96289 shown

Customer Rating

SAVE 70%

$8.99 comp at $29.97

11132761

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SUPER COUPON

2.5 HP, 21 GALLON, 125 PSI VERTICAL AIR COMPRESSOR

CENTRAL PNEUMATIC

LOT 69091/67847 shown 61454/61693/62803

Customer Rating

SAVE $349

$149.99 ~~$179.99~~ comp at $499

11138995

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SUPER COUPON

1 TON CAPACITY FOLDABLE SHOP CRANE

PITTSBURGH AUTOMOTIVE

SAVE $169

LOT 69445/93840 61858/69512 shown

$99.99 comp at $269

- Includes Ram, Hook and Chain

11127719

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SUPER COUPON

29 PIECE TITANIUM NITRIDE COATED HIGH SPEED STEEL DRILL BIT SET

NEW

SAVE 76%

WARRIOR

LOT 5889 62281 61637 shown

$13.99 ~~$19.99~~ comp at $59.97

11145296

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REVIEWS WITH EZRA DYER

1
BASE PRICE: $105,000
EPA MILEAGE: 13 mpg city/ 19 mpg highway

2
BASE PRICE: $41,875
EPA MILEAGE: 20 mpg city/ 27 mpg highway

3
BASE PRICE: $55,645
EPA MILEAGE: 31 mpg city/ 30 mpg highway

1
2016 ASTON MARTIN VANTAGE GT COUPE

Cars get more expensive every year, and now we have a Hyundai that costs more than a year at Harvard. That makes Aston's strategy with the Vantage GT unusual. When the Vantage came out in 2006, it cost about $100,000. The 2016 Vantage GT coupe costs $105,000. Granted, Aston hasn't done much to justify charging more, but its restraint is refreshing when other manufacturers bump prices just because they can. It's still not a car for the people, but thanks to inflation, it's a car for more people.

Back in 2006, the Vantage's main competition was the Porsche 911. Now, the $100,000 market is crowded. The Corvette Z06, Nissan GT-R, Jaguar F-Type, and Mercedes-AMG GT, to name a few, all have customers willing to spend six figures. While the 430-hp Vantage GT includes raucously loud sport exhaust and firmed-up suspension, it won't beat a Vette on the track. What the Vantage will do, though, is be an Aston Martin. It has doors that swoop slightly upward when they open and that signature crystal ignition key. The standard transmission is, well, a standard, so you can gratuitously blip the throttle, enjoying the V-8's raspy chortles in slow traffic.

And most importantly, at a time when you might be sharing the road with more $100,000 cars than ever, yours is probably the only Aston for miles.

2
2016 MERCEDES-BENZ GLC300 4MATIC

A word about Mercedes' nomenclature: From now on, crossovers all begin with "GL," followed by a letter that corresponds to a Mercedes sedan. So the GLC is small, like a C-Class, the GLE is one size larger, and so on. Typically, wholesale name changes confuse—see Infiniti's Q-everything move—but in this case you can understand the logic. Especially since the GLC300 is very much like a C-Class that grew a few inches taller.

Like the C sedan, the GLC aims high when it comes to equipment and technology. There's available lane-keeping steering, air suspension, and a really elegant interior. And while every competitor seems to offer a 2.0-liter turbocharged four-cylinder that makes 240 horsepower (BMW X3, Range Rover Evoque, Volvo XC60), the GLC300 has a 2.0-liter turbocharged four-cylinder that makes *241 horsepower*. Take that, BMW!

The GLC's predecessor, the GLK, was a stylistic oddity in this segment. It was angular and chiseled, like a pugnacious Geländewagen understudy. The GLC is sleek and coupe-like, but retains the GLK's rear-wheel-drive powertrain setup—if your GLC isn't all-wheel drive, it's rear-wheel drive. That's an asset. Rear-wheel drive gives you a trimmer front overhang, better proportions, and sweet handling. If you care about driving, that's reason to care about the GLC300.

3
2016 LEXUS RX 450H F SPORT

Looking at the spec sheet, Lexus's new hybrid crossover looks lame. You can't plug it in, and instead of standard lithium it uses a (cheaper) nickel–metal hydride battery. Its EPA numbers are solid, 30 mpg combined, and the electric motor and gas V-6 team up for 308 horsepower. But the CVT transmission means that full-throttle acceleration feels like a hot-rodded Prius, as if the V-6 is asking, "Why are you doing this? We were getting 30 mpg!"

The performance contradicts the interior, which asks you to mash the accelerator. The seats, deeply bolstered and available in an audacious shade of red, would be appropriate in something with 600 horsepower. Lexus makes them using a new process, "integrated foaming." Rather than upholster pieces of foam, Lexus injects the foam into the upholstery, allowing it to create heretofore unseen complex curves, with no sagging or bunching of the leather. Cool.

The RX is always a big seller for Lexus, perched on the edge of affordability while bursting with that trademark feeling of endlessly finessed attention to detail. The F Sport hybrid is a little bit confounding: It's a sporty version of an inherently unsporty thing, like an optometrist's waiting room stocked with Red Bull. But sometimes, the veneer of sportiness is all you really need.

FIVE-WORD REVIEWS

2016 HONDA CIVIC TOURING Parking attendant: "Dude! *Civic?* Sweeeet!"

2016 MERCEDES-AMG GT S Luxury and horsepower. MSRP? Um.

2016 HYUNDAI SONATA SPORT 2.0T Lotta punch for under $30K.

Cell Phone Inspires Chicago Doctor to Design Affordable Hearing Aid

Outperforms Most Higher Priced Hearing Aids

Reported by J. Page

CHICAGO: A local board-certified Ear, Nose, and Throat (ENT) physician, Dr. S. Cherukuri, has just shaken up the hearing aid industry with the invention of a medical-grade, affordable hearing aid. **This revolutionary hearing aid is designed to help millions of people with hearing loss who cannot afford—or do not wish to pay—the much higher cost of traditional hearing aids.**

"Perhaps the best quality-to-price ratio in the hearing aid industry" — Dr. Babu, Board-Certified ENT Physician

Dr. Cherukuri knew that untreated hearing loss could lead to depression, social isolation, anxiety, and symptoms consistent with Alzheimer's disease. **He could not understand why the cost of hearing aids was so high when the prices on so many consumer electronics like TVs, DVD players, cell phones, and digital cameras had fallen.**

Since Medicare and most private insurance plans do not cover the costs of hearing aids, which traditionally run between $2,000-$6,000 for a pair, many of the doctor's patients could not afford the expense. Dr. Cherukuri's goal was to find a reasonable solution that would help with the most common types of hearing loss at an affordable price, similar to the **"one-size-fits-most" reading glasses** available at drug stores.

He evaluated numerous hearing devices and sound amplifiers, including those seen on television. Without fail, almost all of these were found to amplify bass/low frequencies (below 1000 Hz) and were not useful in amplifying the frequencies related to the human voice.

Inspiration from a Surprising Source

The doctor's inspiration to defeat the powers-that-be that kept inexpensive hearing aids out of the hands of the public actually came from a new cell phone he had just purchased. **"I felt that if someone could devise an affordable device like an iPhone® for about $200 that could do all sorts of things, I could create a hearing aid at a similar price."**

- **Designed by a Board-Certified Ear, Nose, and Throat (ENT) Doctor**
- **Doctor-Recommended, Audiologist-Tested**
- **★★★★★Top Rated Hearing Aid Online—Thousands of Satisfied Customers**
- **Batteries Included! Comes Ready To Use**
- **FDA-Registered**
- **Save Up To 90%**
- **Free Shipping Available**
- **100% Money-Back Guarantee**

Affordable Hearing Aid with Superb Performance

The high cost of hearing aids is a result of layers of middlemen and expensive unnecessary features. Dr. Cherukuri concluded that it would be possible to develop a medical-grade hearing aid without sacrificing the quality of components. The result is the **MD**HearingAid ***PRO***, under $200 each when buying a pair. **It has been declared to be the best low-cost hearing aid that amplifies the range of sounds associated with the human voice without overly amplifying background noise.**

Tested by Leading Doctors and Audiologists

The **MD**HearingAid ***PRO*** has been rigorously tested by leading ENT physicians and audiologists who have unanimously agreed that the **sound quality and output in many cases exceeds more expensive hearing aids.**

MDHearingAid® PRO

Proudly Assembled in the USA
from Domestic & Imported Components.

100% Money-Back Guarantee **45-DAY RISK-FREE TRIAL**

BBB A+ RATING ACCREDITED BUSINESS

Doctors and patients agree:

"BEST QUALITY SOUND"
"LOWEST AFFORDABLE PRICE"

"I have been wearing hearing aids for over 25 years and these are the best behind-the-ear aids I have tried. ***Their sound quality rivals that of my $3,500 custom pair of Phonak® Xtra digital ITE."***
—Gerald L.

"I have a $2,000 ReSound® Live hearing aid in my left ear and the MDHearingAid *PRO in the right ear.* ***I am not able to notice a significant difference in sound quality between the two hearing aids."***
—Dr. May, ENT Physician

"They work so great, my mother says she hasn't heard this well in years, even with her $2,000 digital! ***It was so great to see the joy on her face.*** *She is 90 years young again."*
—Al P.

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FREE Shipping Available

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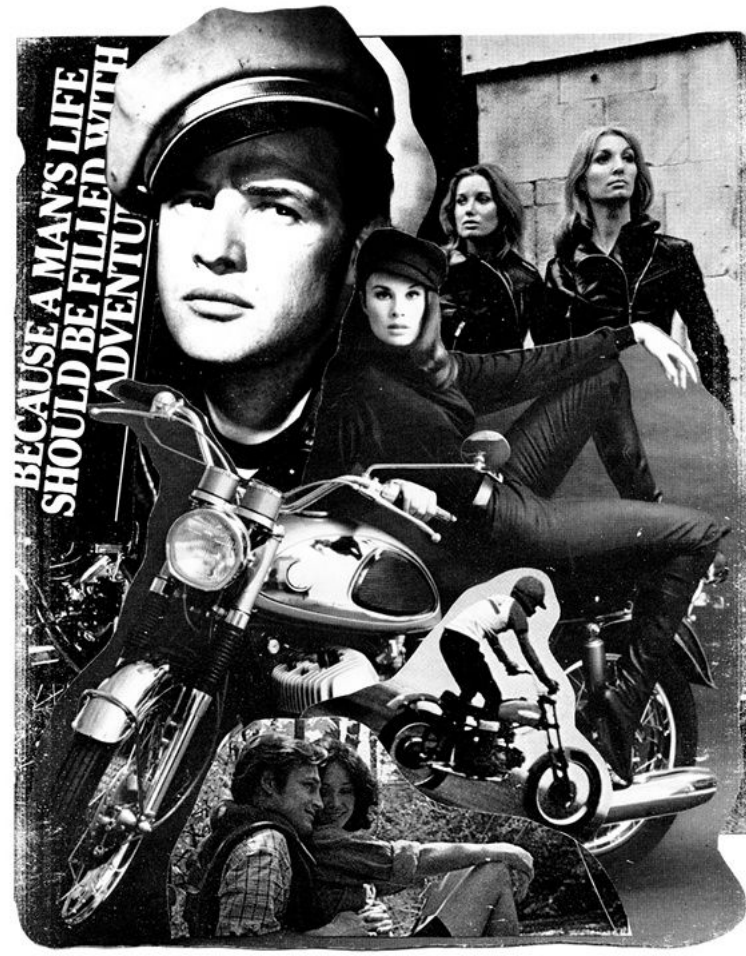
RIDING WITH BUZZ BISSINGER

Welcome to Biker Land

THERE ARE A LOT OF REASONS TO START RIDING A MOTORCYCLE—THE THRILLS, THE CLOTHES, THE COMMUNITY. BUT THE BEST IS THE SIMPLEST: THE GIRL.



My wife, Lisa, has been a biker for more than 40 years. As a teenager, she had a boyfriend who rode a Hercules. He was a maniac, prompting Lisa to get off the back of his bike and teach herself how to ride on a 1969 BMW R60/2. She is impossibly cool and sexy when she rides. The leather jacket with just enough jagged scuffs. The well-worn gloves slipped over the cuffs. The way she shakes her luscious mane of jet-black hair after she takes off her helmet. Every man who does not ride is a sucker for a woman who does.

We met in 1998 in Seattle. After copious amounts of booze and cigarettes at the hip late-night spot Palace Kitchen, she took me back to her house to see her bike, another '69 R60/2. Without going into detail—although this is a magazine dedicated to detail—it turned out to be a very dazzling night, the equivalent of a 1,200-cc V-twin.

I knew Lisa loved me when several weeks later she let me try the bike. It had a kick-starter that would not budge. Lisa gently asked me to step aside and turned it in one downward stroke. She then carefully showed me the basics: the clutch and shift levers, the front brake lever and back brake pedal, the throttle. I pulled in the clutch and revved up the throttle. I did not stall out. I was impressed with myself. Lisa was not.

"Why are you revving the throttle?" she asked.

"Isn't that what Sal Mineo did in *The Wild One*?"

"Sal Mineo wasn't in *The Wild One*."

"Anyway, that's what all bikers do in biker films."

"You realize revving the throttle like that is pointless unless you ride a Harley-Davidson and think you're required to make a lot of noise."

Lisa told me it was all about timing: clutch lever slowly out, throttle slowly open, smoothing into first gear, and then clicking it up the ladder. Her last words were "Just don't tip it."

Well…

Lisa came running.

"Are you okay, baby? Is anything hurt?"

Just for the record, I was fine, too. Thanks for asking.

Lisa promised another lesson soon. Sixteen years later, with me on the cusp of 60, it still hadn't happened. I hadn't touched a motorcycle since.

I always felt terribly left out. Lisa often described to me the singular feeling of being completely in the moment on a motorcycle, every fiber of focus on the ride to the exclusion of all else, the way in which the seasons change in the course of a single mile—the summer heat of a straightaway, the autumn cool as you slice through a shade of trees.

She belonged to Seattle's Vintage Motorcycle Enthusiasts club and had a coterie of male biker buddies. They rode Indians, Ariel Square Fours, Norton Manxes, and Aermacchis. And, as far as I could tell, they had not shaved since 1967. When Lisa got on the phone with one of them or saw them in person—usually at Seattle's legendary repair shop Poke's Cycle, which has since closed—they might as well have been speaking in tongues: pistons and pushrods and crankcases and camshafts. Since the only method of propulsion that had ever made intuitive sense to me was the car Fred Flintstone drove, the language was intriguing. So was how they all seemed much happier when their bikes *did not* work than when they did. Discussions became animated as each expressed their own diagnosis with absolute conviction—even after being overruled.

The brotherhood and sisterhood of bikers was definitely a little weird. But there was also something beautiful about them, an entire culture dedicated not only to their bikes but also to each other. They were individual and idiosyncratic, the last gasp of American renegade, the essence of existential freedom, hitting the road and passing minivans in which families headed for some crowded vacation spot already were trying to kill each other.

I got tired of wondering what it would be like to ride a bike. You only live once—although many would argue that bikers don't even live that long, given the danger. That was part of it too: a way of feeling young and daring, a late-life crisis where the red sports car wouldn't work because I had already done the red sports car in the midlife crisis.

So in the summer of 2014, I told Lisa I was going to learn how to ride. She supported and encouraged me, although she thought I had little shot of staying upright. I was determined to prove her wrong.

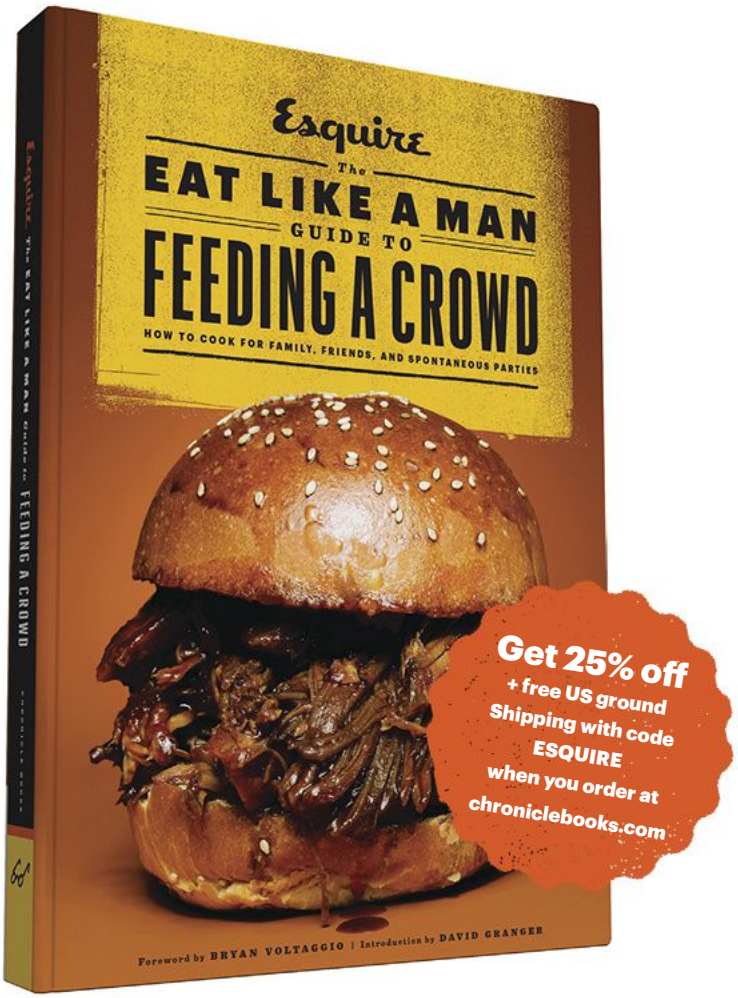
NEXT MONTH

Buzz Bissinger is a Pulitzer Prize–winning journalist and the author of *Friday Night Lights*. In next month's issue, he takes his motorcycle license test…on a Yamaha scooter.

PHOTO ILLUSTRATION BY BRUNO GUERREIRO

The only cookbook you'll ever need when the party is at your place!

The ultimate resource for guys who want to host big crowds and need the scaled-up recipes, logistical advice, and mojo to pull it off. Whether they're cooking breakfast for a houseful of weekend guests, producing an epic spread for the playoffs, or planning a backyard BBQ. Includes more than 80 recipes, with favorites from chefs such as Tom Colicchio, Mario Batali, and Bryan Voltaggio.



ADVERTISEMENT

The Esquire Manhattan

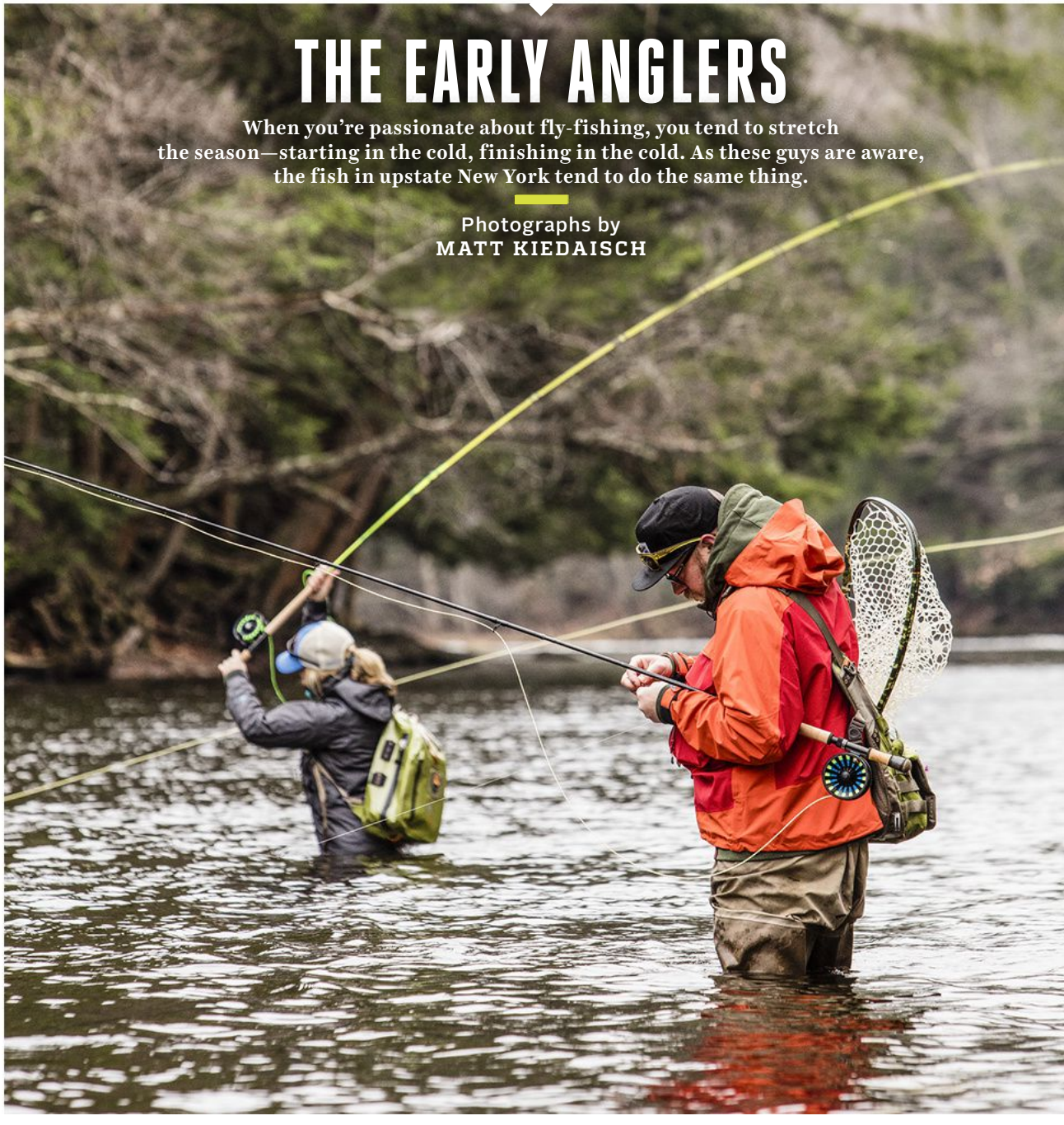
is made with superior Jefferson's bourbon and a combination of the finest sweet and dry vermouth and bitters. Crafted with the editors of Esquire and barrel-aged for 90 days, the result is a damn good cocktail. Serve it up or on the rocks. No labor or equipment needed.

AVAILABLE AT FINE LIQUOR STORES NATIONWIDE

THE EARLY ANGLERS

When you're passionate about fly-fishing, you tend to stretch the season—starting in the cold, finishing in the cold. As these guys are aware, the fish in upstate New York tend to do the same thing.

Photographs by
MATT KIEDAISCH



Pulaski, New York, is about three and a half, maybe four, hours from just about anywhere. It took that long for two collectives of fly fishermen—the guys of Pigfarm Ink Nor'eastah from New England and the Vermont Fly Guys out of Highgate Springs, enthusiast groups of men and women who found each other on Instagram and Facebook and meet in real life on weekends—to get up here on Friday evening. They gathered at the Tailwater Lodge, an old school that's been converted into a resort for the modern outdoorsmen who flock here when the steelhead run strong, October through May. The two groups had sponsored and organized a local fly-tying competition for Friday, a small event for themselves, the locals, and a couple of teens from the area to trade ideas, stories, and tips. Brian Price of the Vermont Fly Guys issued challenges suited to a reality-cooking competition: Tie a fly blindfolded, tie a fly in the opposite direction—from its rear end to its mouth.

When they convene at seven the next morning, some more groggy than others, the talk is of where and what others had caught Friday and where the best chances will be today. They brag about their gear, stow away some beers for later, and drive off to their favorite holes. As they quietly space themselves out along a couple hundred yards of the Salmon River, the meditative rush of the water and the zip of casts take over. A fish pulls, and "Fish on!" telephones down the river. Everyone pauses their own casting, a few gather on the bank near the guy who's snagged a bite. Someone will man a net. If things go right, the angler will get a round of pats on the back. He'll hand his phone over to one of his buddies for the photo op. They'll all marvel at the fish, determined now to go get one themselves. And the guy who caught it will take one more look at the chromed-out steelhead, log it in his cache of stories to tell back at the lodge, and set the fish back in the water. *—Matt Goulet*

A

B

C

(A) SOMETIMES YOU SWIM

The reason those waders look wet: Chris Samson, a veteran member of the New England–based crew Pigfarm Ink Nor'eastah, is not afraid to go deep when he needs to.

Howler Brothers hat ($29), Patagonia Field shirt ($169), Patagonia Bandito shirt ($89). Pins, Samson's own.

(B) STAKE OUT A SPOT

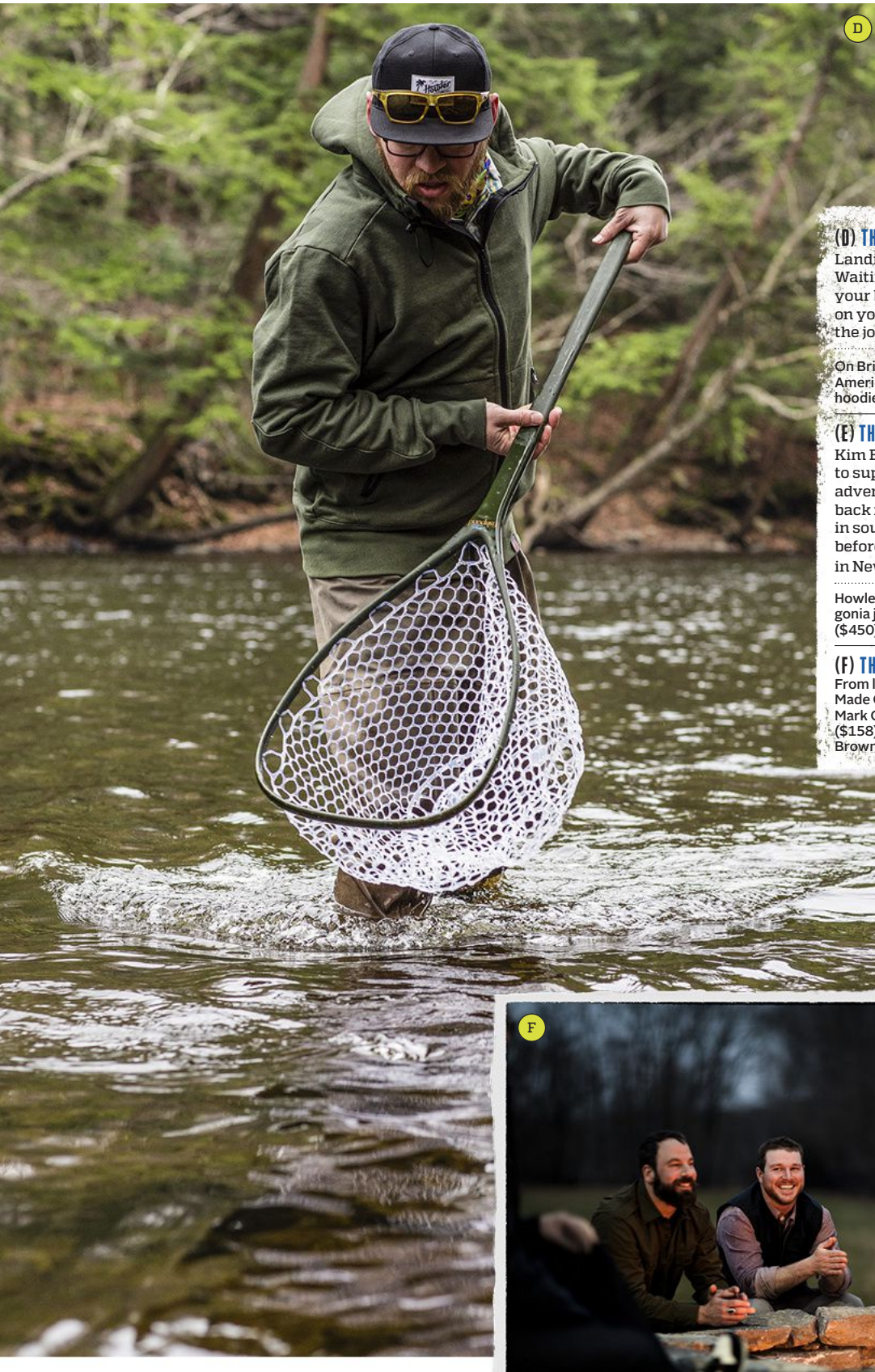
Grundéns jacket ($380), Simms pack ($150), Sage Pulse rod ($450), Sage Domain reel ($385).

(C) THE MASTERMIND

Brian Price of the Vermont Fly Guys turned his fly-tying hobby into a bona fide business four years ago, tying custom-order flies sold at local fly shops.

Howler Brothers hat ($29), Salt sunglasses ($460), Buff neck gaiter ($25), L.L. Bean shirt ($55). Simms waders, Price's own.

Page 63: On Kim Bryant: Fishpond Thunderhead sling ($200). On Brian Price: Simms G3 Guide jacket ($450), Redington Chromer rod ($400), Redington Behemoth reel ($130).



(D) THE ASSIST

Landing a catch is just step one. Waiting out the fish and having your buddy net it while it's still on your line makes the rest of the job easier.

On Brian Price: Fishpond net ($220), American Giant Storm Full Zip hoodie ($119).

(E) THE PROFESSIONAL

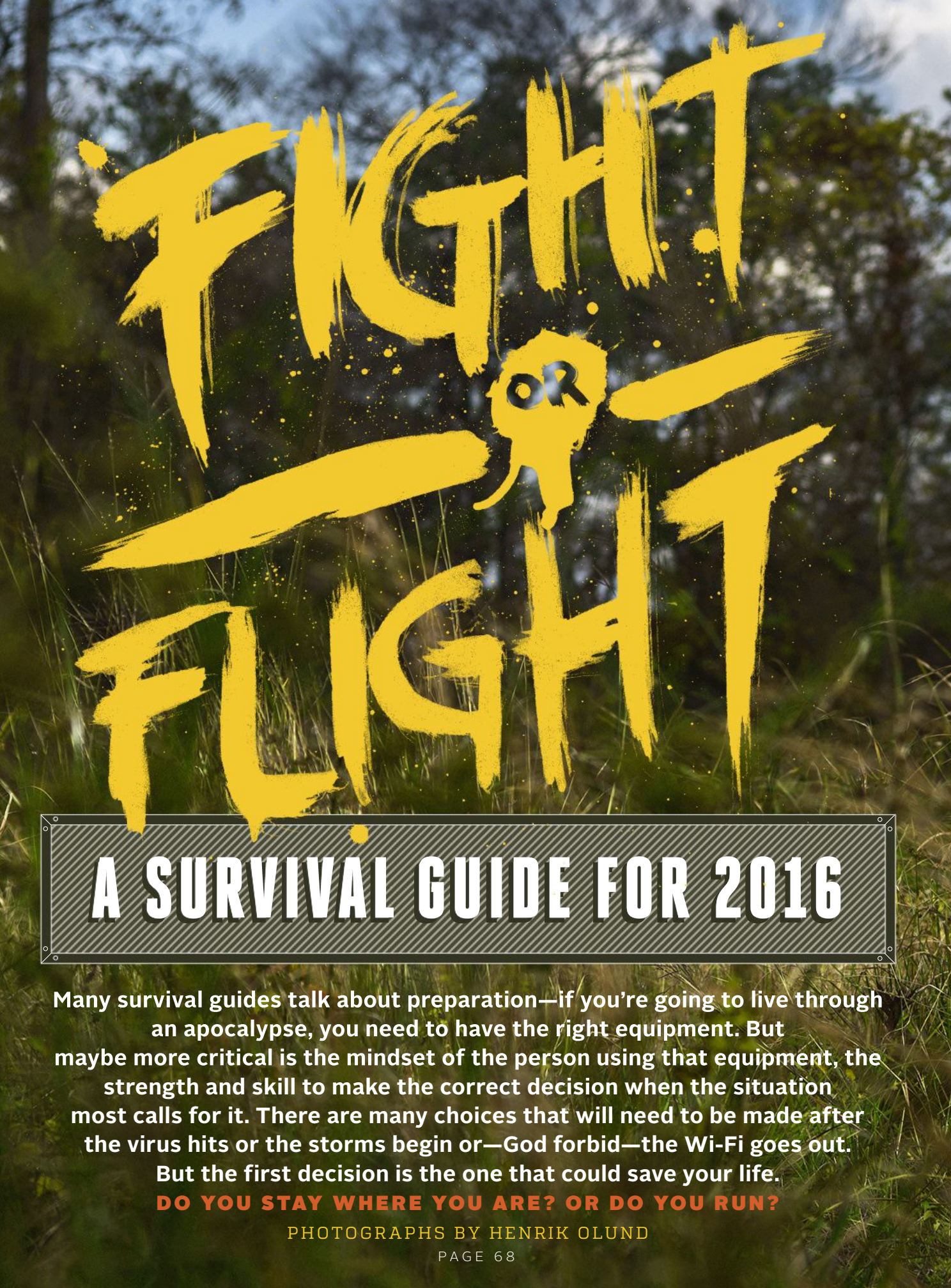
Kim Bryant works as a guide to supplement her own adventures. She'd just gotten back from pheasant hunting in southwestern Montana before the fly-tying weekend in New York.

Howler Brothers hat ($29), Patagonia jacket ($349), Sage Pulse rod ($450), Sage Domain reel ($385).

(F) THE RECAP

From left, on Chris Samson: Best Made Co. Field shirt ($148). On Mark Collins: Best Made Co. pullover ($158), Filson vest ($225). On Greg Brown: Simms Guide shirt ($80).

SMITH
sage PULSE



A SURVIVAL GUIDE FOR 2016

Many survival guides talk about preparation—if you're going to live through an apocalypse, you need to have the right equipment. But maybe more critical is the mindset of the person using that equipment, the strength and skill to make the correct decision when the situation most calls for it. There are many choices that will need to be made after the virus hits or the storms begin or—God forbid—the Wi-Fi goes out. But the first decision is the one that could save your life.

DO YOU STAY WHERE YOU ARE? OR DO YOU RUN?

PHOTOGRAPHS BY HENRIK OLUND

When a hiking buddy slid down a rocky cliff in Alaska's Denali National Park, Chris Scruggs, twenty-eight, spent the next eleven hours searching for help.

THE DECISION

To have any chance of saving his friend, a hiker has to leave him behind.

BY KEVIN DUPZYK

JUST HOURS EARLIER, they had thought the night in the boulder field worth it. Chris Scruggs and Zach McCutchen had finally crested a ridge in the Alaska Range that they'd nearly killed themselves trying to reach. Mt. McKinley, North America's mightiest peak, was only thirty miles away. The clouds that had dumped rain on them all night cleared. Looking into the valley on the other side of the ridge they could see glacial melt gathering into streams, streams gathering into rivers, rivers draining the imposing landscape of Denali National Park. The scene was majestic, worthy of their hard work.

But then they'd started picking their way down the other side of the ridge. It was a steep slope, covered in talus, broken shards of rock so loose any step could start a slide. The rangers had said to be careful, choose a good route, and follow it down.

Scruggs and McCutchen both had backpacking experience, but not like this, in a place

with no trails. They realized they'd have to work together, testing different routes to find terrain they could negotiate. That's what they were doing when McCutchen started to slide. When he came to a stop, he was straddling a triangular ledge of rock just a few feet wide. Below him was a thousand-foot drop. Every other direction was nearly vertical and too loose to climb. He found stability on his perch by turning to face the mountain, but there was nowhere to go. He yelled to Scruggs, who was some hundred feet away, to go get help.

If Scruggs were going to hike out, this wasn't the way he wanted to do it. They had no way to exchange gear—McCutchen was too delicately balanced to throw anything, even if they hadn't been so far apart. That left them with only what they'd each had in their packs since the morning: Scruggs had food and the water purifier. McCutchen had everything else: Rope. Shelter. GPS. Maps.

Scruggs asked his friend again and again if he was sure: Did he really want Scruggs to leave him there? McCutchen insisted. Looming in the minds of both hikers was the night before, in the boulder field. They'd spent the whole previous day—their second in Denali—trying to reach the ridge. After breakfast and a small lunch, they'd become so focused they had forgotten to eat again. It grew cold and rainy. They couldn't see through the clouds hovering on the mountainside. They were forced to bed down among boulders the size of small cars, wedging their feet against them to stay in place. Rain got in the tent. Loose rocks crashed down the slope all around them. They'd slept an hour or two, if that.

Which left them here: hungry, thirsty, and exhausted. After the previous night, Scruggs had no idea whether either of them would be able to make it through another. McCutchen had no water, and if he fell asleep he'd almost certainly fall to his death.

Scruggs told his friend that he'd find help that day, that McCutchen wouldn't have to spend the night alone on a cliff. It was 8:30 in the morning. He set off down the mountainside, moving as fast as he could.

Scruggs knew that all the rivers flowed north from where he was. The park road ran east to west. He figured when he reached the bottom of the talus slope, he'd follow a river until he hit a bridge.

Adrenaline kept him moving. The river was sinuous, with heavy brush. He stopped only to take pictures—without a map, he'd need them to direct rangers back to McCutchen. After a while, he fantasized about seeing a bridge around every bend in the river. Finally, he saw it: a man-made oasis. It was 7:30. He'd hiked eleven hours straight, covering nearly twenty miles. They'd only managed ten the day before.

Scruggs flagged down a park bus, and rangers got word to the Alaska Air National Guard in Anchorage, who dispatched Black Hawk helicopters. By the time the helicopters spotted McCutchen, weather was rolling in and visibility was too low to extract him. They dropped off a mountaineer to help him stay awake until morning, when he could be plucked off the precipice.

Once Scruggs learned that his friend had been found, that he had fulfilled his promise, he crashed. In the morning, rangers took him to meet McCutchen as he got off the helicopter. The last time Scruggs had seen McCutchen, he could barely make out his orange backpack cover against the brown mountainside. That was early in the trek, as Scruggs was leaving the first valley. He couldn't keep looking back.

BRING THESE

Stuff to pack if you want to live.

Stuffed into one handle of Leatherman's new 7.5-ounce Signal multitool is a pop-out emergency whistle. Embedded in that, a fire-starting ferro rod. And, God forbid you should need to perform post-apocalyptic surgery of some sort, the diamond file in the opposite handle disconnects from the tool, so you can keep your blades extremely sharp.

ITEM	PRICE
Leatherman Signal	$100

Stay comfortable in the gnarliest storm with a canister of UCO's Stormproof matches that stay lit through wind and rain, a Mylar tube tent that fits two grown adults, and a mini collapsible stove with solid-fuel tablets, all in a package the size of a CD case.

ITEM	PRICE
UCO Stormproof Survival Kit	$20

ITEM
Survival Laces
PRICE
$24

Pull off the aglet (yes, there's a word for the tube at the end of a shoelace), and there's fishing line to catch dinner and a ferro rod and tinder to start the fire to cook whatever you catch.

ITEM
Atmotube
PRICE
$89

Unlike in video games, in real life poisonous air doesn't show up as an obvious green cloud. Dangle this cylinder from your bug-out bag, and you'll get a push notification on your phone if you cross into polluted airspace.

ITEM
Mophie Powerstation 8x
PRICE
$150

In addition to recharging an iPhone 6s eight times, this supplementary battery will hold its charge for years without degrading, which means stashing one in case of emergency is a hell of a lot more efficient than pulling a tiny solar panel out of your pack and waiting for it to charge. Put your phone in Airplane Mode while it's plugged in and it'll charge faster.

ARE YOU NECESSARY?

A helpful quiz.

Which of these best describes your day job?
- ○ **A.** I'm a desk jockey.
- ○ **B.** I'm an outdoor instructor.
- ○ **C.** I'm a doctor.

Wait a minute. What kind of doctor?
- ○ **A.** I have a doctorate of philosophy in a very important . . .
- ○ **B.** Reattached a guy's ACL the other day.
- ○ **C.** Okay, I lied. I'm an EMT.

You bring anything with you?
- ○ **A.** The latest Jack Reacher. Jeez, he's resourceful.
- ○ **B.** A couple Clif bars and a headlamp.
- ○ **C.** My bug-out bag. Obviously.

We need to build a fire. Can you help?
- ○ **A.** Sure. Lighter fluid?
- ○ **B.** Tepee or log cabin?
- ○ **C.** Hand me those two sticks, would ya?

You hear that?
- ○ **A.** Huh?
- ○ **B.** Let's take cover.
- ○ **C.** Of course. I've been tracking this deer for miles.

KEY: If you answered...

- **Mostly A's:** You're more likely going to be dinner than to eat it with us.
- **Mostly B's:** You're pretty necessary.
- **Mostly C's:** Do you want to be our leader?

THE REAL UTILITY BELT

After surviving three fires in various New York City apartments, I needed a reliable escape plan. Preferably one that I could wear.

BY DANIEL DUBNO

SOME PEOPLE LOOK for the nearest exit when they enter a room. I look for the nearest window. It's a habit I developed after surviving three fires in my apartment—right after buying more fire extinguishers. Since I can't carry a fire extinguisher with me, I need another means to reassure myself I can escape. The only way to know that for sure is to locate a window. And to wear my belt.

The belt, which I wear every day, was inspired by my friend Dr. Marvin Minsky, the MIT professor widely regarded as the father of artificial intelligence. Many years ago, he knitted a rescue belt out of 550-pound test military-grade paracord. If there's ever an emergency—and there have been at least two: once when a hiker fell into a crevasse and another time when his daughter got stuck in quicksand—he unravels his belt and saves the day.

I bought my belt from Survival Straps. It's thick, a hundred-plus feet of crocheted paracord that I can unspool and use to lower myself to the ground. It's good, but it could be better. Safer. I've been working on adding a miniature climbing descender that doubles as a belt buckle, but it still isn't ready to deploy. In the meantime, I keep a backup at home: a climbing harness, two hundred feet of rope, and an Anthron Descender. Just in case, I also keep a pair of gloves handy to protect against rope burns. I would wear those all the time, too, but they don't look so good with a blazer.

THE BEST ESCAPE VEHICLES

✖ **Unless you need to get a large group of people somewhere slowly, an SUV is probably worthless in an emergency. These vehicles will save you then.**

BEST FOR A TSUNAMI

GIBBS QUADSKI

In front of you: a traffic jam. Behind you: a rapidly approaching wall of death by seawater. You're glad you've got a Gibbs Quadski, an ATV that can hit 45 mph on either land or water. Retract the wheels, fire up the jet drive, and keep heading inland. Or out to sea. It doesn't really make a difference at this point, does it?

BEST FOR A BLIZZARD

RAM ECODIESEL 4X4 ON TRACK N GO SNOW TRACKS

You want the diesel for range—you can't count on gas stations being open. The Track N Go system is like truck snowshoes. Bolt one on each corner and your pickup is now a snowmobile. Now let's quit this talk of the Donner Party. It just started snowing.

BEST FOR AN ARMED INSURRECTION

MERCEDES-BENZ S600 GUARD

When the peasants get their pitchforks, flee to your private bunker in comfort and safety. The S600 Guard looks like a regular S-Class, but its armor stops common small-arms fire and the underbody is designed to thwart grenades and mines. To the helipad!

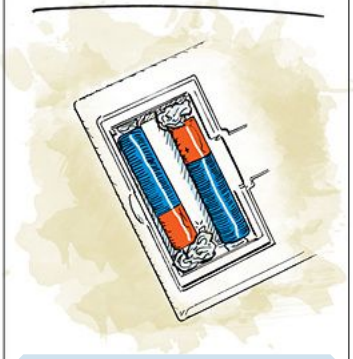
BEST FOR AN EARTHQUAKE

HONDA CRF1000L AFRICA TWIN

When landslides block the road, you need a bike. Honda's big adventure cycle has knobby tires and long-travel suspension, and its torque management and available dual-clutch automatic transmission will help you escape the epicenter. —*Ezra Dyer*

SHOP NOTES: Survival Edition

FAKE AA BATTERIES



If your flashlight or radio needs AA batteries and you only have AAAs, ball up some aluminum foil and use it to close the gap between the end of the smaller AAA battery and the terminal. AAAs used in place of AAs will die faster, but they'll work.

PURIFY WATER WITH REGULAR, UNSCENTED BLEACH

Add ¼ teaspoon per gallon of water and let stand for 30 minutes. Then sniff it. If it smells a little like chlorine, it's drinkable. If not, add more bleach and wait 15 more minutes.

CRAYONS CAN REPLACE CANDLES

If you run out of candles, a crayon will burn for up to half an hour, and a piece of cotton string in a can of shortening such as Crisco will burn for much longer—up to 45 days.

START A FIRE WITH YOUR SMARTPHONE

To start a fire with your smartphone, take out the battery. (If it's an iPhone, break it open. The only other option is to use a pentalobe screwdriver, which you probably don't have.) With gloves on, cut off the ends of the battery with a knife to expose the terminals. Place the knife or steel wool along both terminals to short-circuit the battery, which will create sparks. You can also just stab the battery to expose the lithium to oxygen, creating heat and sparks. In either case, hold over kindling to start a fire.

SAVE YOUR LIFE WITH ELECTRONICS

The thin wires inside Taptic Engines (the motors that make electronics vibrate) in any phone can be used as sutures.

CAUTION!

Laptop chassis are made partially of magnesium. Flake some off with a knife, pulverize it, and add three parts rust to one part laptop. This is thermite, which, once lit with a butane lighter, will burn hot enough to cut through metal and concrete.

Crack open your tablet and prop the metal back casing over a fire. Now you have a griddle.

USE HIDDEN WATER

If your faucets aren't working, what's in the tank of your hot-water heater is usable (but you should still boil or bleach it before drinking).

To retrieve it, turn off the power to the hot-water heater, whether electric or gas.

Close the tank's supply valve.

Put a bucket under its lower drainage valve.

Open a hot-water tap somewhere in the house to let air into the system and water will begin to drain.

HOMEMADE LANTERN MADE OF STORED SUPPLIES

Turn a headlamp into a proper lantern by wrapping it around a clear two-gallon milk jug full of water, which bounces the light in all directions.

With thanks to ifixit.com

ILLUSTRATIONS BY TED SLAMPYAK

Stuck on the side of a highway in the middle of a New York blizzard, an army veteran has to make a decision to stay or go. And no one is coming to help. **BY ROBERT VRABEL**

ON HALLOWEEN IN 2011, the snowstorm in the forecast was so severe that the holiday was effectively canceled. Every town around was either advising against trick or treating or outright banning it. The snow and ice weren't supposed to start pounding until the evening hours, so I felt confident driving to pick my kids up from a sleepover at my parents' house—about a forty-minute drive.

The nor'easter came even faster and harder than the forecasters said it would. By the time I reached the interstate, it was approaching whiteout. But my 2004 Chrysler Pacifica had all-wheel drive, so I still felt I could make it to my parents' place and just spend the night there with the kids. That's when some jackass in a Honda Pilot veered into my lane without looking, slamming into my front fender and sending me careening into the car next to me, which happened to be a New York State Trooper in an unmarked car. The officer and I both smashed into the highway's side barrier.

After the accident, neither car was drivable but the trooper's car had taken much more damage and the engine wouldn't start, so he lit a couple of flares and sat in my SUV with me because I had heat. He turned out to be a nice guy. The driver of the tow truck that came for the trooper told me a second truck wasn't far behind. I watched traffic pass for nearly an hour in the warmth of my cab until, slowly and then all at once, the highway was empty. My cellphone had 17 percent battery power left. I called the towing company, and the guy who answered told me a tractor-trailer had flipped onto its side farther down the highway, blocking traffic. My tow truck was trying to find a way around. The sky grew darker. The snow fell harder and harder, and even harder still.

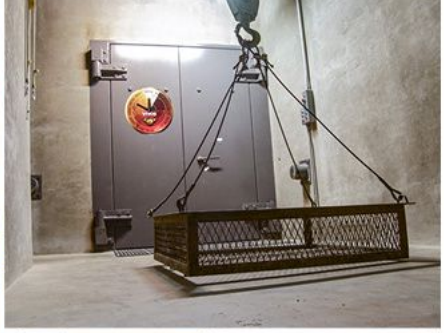
I now faced a major decision: Walk for help or stay in the car? I'd made it to within eight miles of my parents' home, which under normal conditions is a walk I can manage easily. I had done twenty-five miles many times in the Army, with an eighty-pound rucksack on my back. I stepped outside to assess the conditions. It took about nine seconds for me to determine that my clothing—a sweatshirt under a light North Face jacket, jeans, and hiking shoes—wouldn't keep me safe from frostbite or hypothermia. As a private, I once spent a particularly harsh winter in Bosnia, and I remember the higher-ups drilling it into our heads to keep our socks dry or else. My hiking shoes were not waterproof.

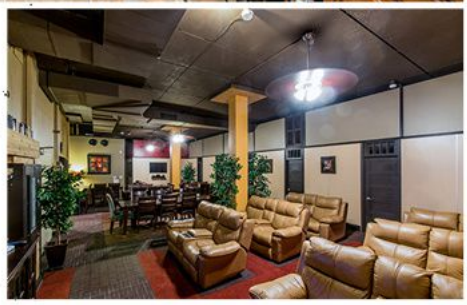
I examined the SUV. I had no food and a single bottle of water that I had grabbed before leaving. The gas tank was only an eighth full. I decided that, to avoid freezing to death, I'd turn the engine on to warm up and then shut it off until I was cold enough to need it again. The SUV was tilted at such an angle that I periodically ventured out into the knee-high snow to clear out the tailpipe in case I fell asleep, so I wouldn't die of carbon monoxide poisoning. That would be a pretty stupid way to go.

After six hours or so, day began to fade into night. My phone allowed me to call my family and the police, but then died around 1 a.m. I was too focused on staying alive to sleep. I turned on the headlights and watched the snow tumble through the beams of light. At one point, must have been around 4 a.m., I walked into the middle of the highway. There was something surreal about standing in the center of a major interstate and not hearing a sound other than the wind and the ticking of snow against my jacket.

Eventually a hint of sun on the horizon lit up the snowfield around me. I had used all of the gas starting and stopping the car for heat, but the sun would warm things up, so I finally felt relaxed enough to try to sleep. As soon as I dozed off there was a knock on the window. I opened the door to find another trooper, who told me a truck was finally coming. Thirty minutes later, the SUV that had saved my life was loaded onto the flatbed. I had been in the car for eighteen hours.

Vrabel, photographed recently in his driveway, was less than an hour from home when he got trapped for eighteen hours.





THE ARK

Do you know where you'll ride out the apocalypse? The members of Vivos do.

TO SAY THAT Robert Vicino has thought of everything would be a colossal understatement. The website of his apocalypse-shelter company, Vivos, contains links about pets, social hierarchy, clothing, and religion. He's created a free vault for human DNA to which anyone can submit a sample. The following sentence appears in the advertising copy for his seventy-six-acre bunker somewhere under Europe: "If you believe in the prophecies and predictions of the Bible, Nostradamus, the Third Secret of Fatima, the visions of Edgar Cayce, and all of the current signs of an economic collapse, future nuclear war, WW3, a pandemic, an EMP power outage, a Yellowstone eruption, a potential asteroid collision, Nibiru, Planet X, Fukushima's eventual meltdown and widespread global radiation, the coming pole shift and/or major earth changes, it is time to prepare."

Since founding Vivos in 2008, Vicino, sixty, has built dozens of secure doomsday shelters all over the world that charge $35,000 to $5 million for a berth when the end times come. "I've been on this mission for thirty-five years," he says. "I had this inspiration that I needed to build shelters for thousands of people for something that's coming our way that's going to be an extinction-level event." Vicino sees himself as a twenty-first-century Noah. His goal: building enough shelters for seven thousand people, one for every million on earth.

The bunker known as Vivos Indiana contains exercise equipment, ATVs, a theater, and a workshop and costs $35,000 a spot.

Vivos Indiana, a shelter that, were it a hotel, would win awards from AAA, is located somewhere beneath its eponymous state. (The exact location is, understandably, secret.) It contains eighty spots, most of which are filled. The handful of berths that remain are being reserved for electricians and plumbers, necessary professions that so far haven't ponied up the required $35,000 a head. Inside the complex, a Cold War bunker built to withstand a twenty-megaton nuclear explosion, the amenities reflect the price tag: six-hundred-thread-count sheets on queen-sized mattresses, hydroponic vegetable gardens, a movie theater with more than five thousand films. There will be active and former military officers to provide security, doctors to tend to the wounded, and engineers to keep the shelter running properly. Members are handpicked to create a balanced society, like a freshman class at Harvard.

If the apocalypse does occur, there won't be a formal "World seems to be over, stop by when you can" invitation. The members will just make their way toward the bunker whenever they feel it's necessary, and a full-time attendant will let them in. That is, assuming they can get there: Vivos offers biannual retreats to help everyone get acquainted, but only about a quarter of the members make it, and that's with the Federal Aviation Authority and the interstates running smoothly.

The retreats are one way Vicino hopes to avoid any eschatological unpleasantness. Though haven seekers will have a large incentive to behave themselves, the crushing realization that everyone and everything they've ever known is gone is likely to be stressful. Will there be power struggles? Will everyone get along?

"Nobody knows how they're going to act under such stress," Vicino says, but he also says the members will absolutely survive. "We're going to do whatever we have to do. We're going to be a society that's either going to get along or we're not, but I can guarantee we're going to be a much better society than the one that's struggling on the surface." —*Cameron Johnson*

THE ULTIMATE SURVIVAL PANTRY

If you're stuck in your house for an extended period of time, you could live on MREs and chocolate bars. Or you could eat like a king.

BY CHARLIE PALMER

SHOPPING LIST

Proteins

- ☐ Canned ham
- ☐ Canned salmon
- ☐ Dried bottarga
- ☐ Grated Parmesan
- ☐ Barbecue jerky

Carbs

- ☐ Jasmine rice
- ☐ Canned beans (black, kidney, garbanzo, refried)
- ☐ Dried beans (mung beans, Rancho Gordo mixed varieties)
- ☐ Pasta
- ☐ Bread crumbs

Broths/Liquids/Veggies

- ☐ Really good olive oil
- ☐ Canned tomatoes
- ☐ Low-salt vegetable, chicken, and beef broths
- ☐ Pumpkin purée (for thickening soups)
- ☐ Evaporated milk
- ☐ Carrot and tomato juice (to add acidity)
- ☐ Canned corn
- ☐ Canned peas

Spices/Flavors

(In addition to pantry staples)

- ☐ Curry
- ☐ Chili seasoning
- ☐ Canned green chiles
- ☐ Harissa
- ☐ Tomato sauce
- ☐ Salsa
- ☐ Ketchup
- ☐ Pastes (tomato, garlic, onion, pesto, chipotle)

1

canned beans +

vegetable broth +

pumpkin purée +

chili seasoning

THREE-BEAN CHILI

2

white beans +

chicken stock +

canned ham +

rosemary

WHITE-BEAN SOUP

3

canned corn +

evaporated milk +

green chiles +

barbecue jerky

BARBECUE CORN

4

pasta +

canned peas +

canned ham +

evaporated milk +

Parmesan +

bread crumbs

PASTA AND PEAS

Charlie Palmer, an avid outdoorsman, is a celebrity chef who oversees more than a dozen restaurants. He is also the author of *Remington Camp Cooking.*

SURVIVAL GUIDE 2016

HOW TO THROW A HURRICANE PARTY

When you live in a place prone to life-threatening storms, you can leave, or you can get used to it.

EVEN COMPARED TO Florida's usual propensity for getting clobbered by tropical weather systems, the 2004 hurricane season was ludicrous. In six weeks, four hurricanes (categories 4, 2, 3, and 3) slammed into the state, flooding central Florida and demolishing towns on both coasts. By September, the cities were so littered with leaves and tree branches it looked like the streets had been drawn in green crayon. No one's hair had been straight in months. School officials postponed the season-opening football game between Miami University and Florida State, which I think requires a special dispensation from God.

I don't remember which of the four storms occasioned the slip-and-slide, only that it must have been toward the end because we were getting restless. Every new hurricane had brought the same routine: Replenish the stockpile of water and food, fill the car with gas, and go to a hurricane party, a tradition among residents of the southeast, where hurricanes hit so often everyone's got a friend who's rebuilt a house at least twice. Usually, someone who lives on high ground offers shelter in exchange for conversation, games, and booze. You show up, drink beer. Wait for the power to go out. Repeat.

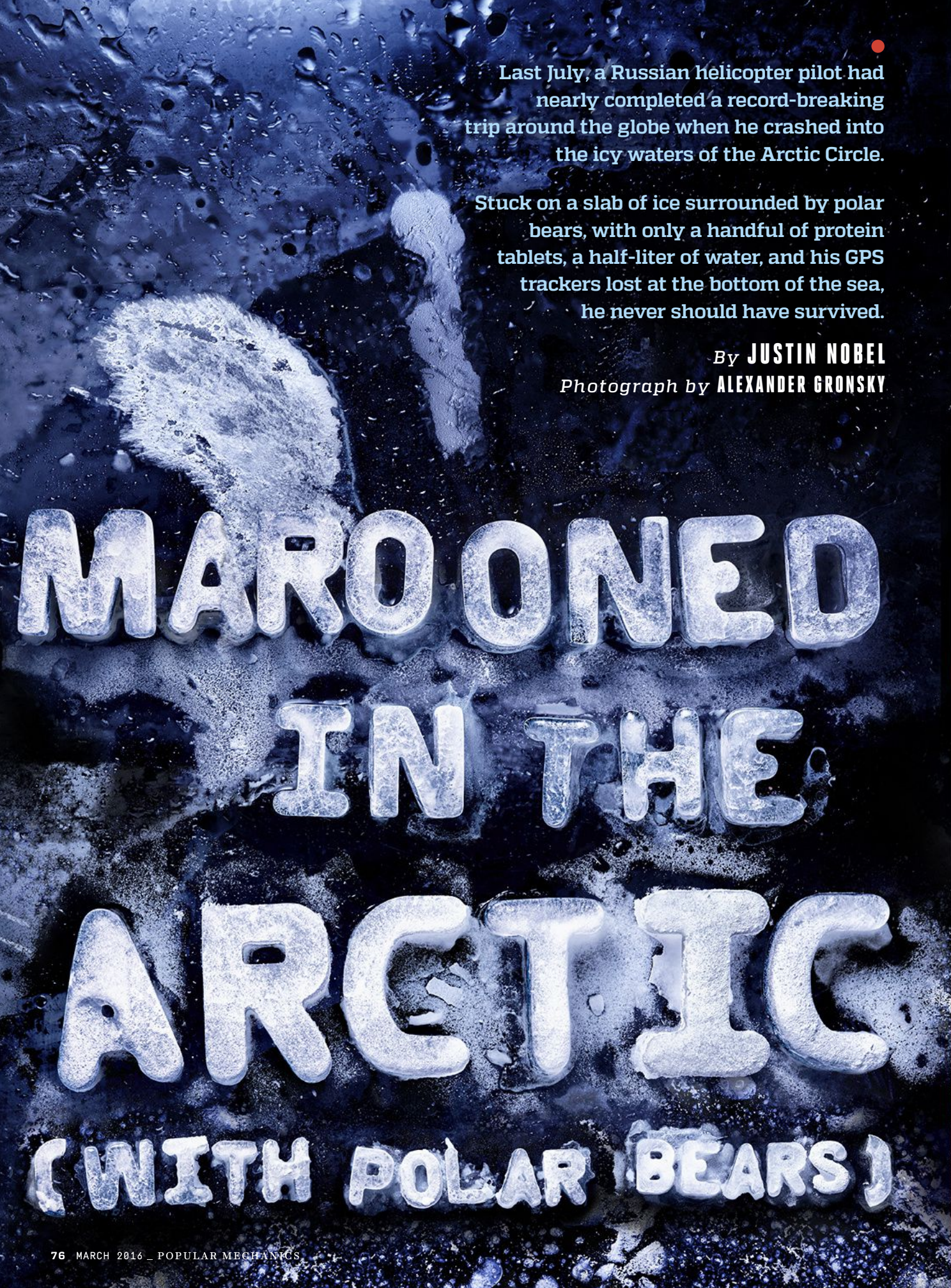
A hurricane party is sufficient entertainment for a single natural disaster, but by the time of the slip-and-slide we'd told all our best jokes. Everyone was out of stories, and if one more person suggested a game of gin rummy it was going to come to blows. The task of staying alive, when it's your only responsibility, can be grating.

Behind my apartment was a tantalizing hill—long and high with a double dip in it. The day of the slip-and-slide, my roommate's boyfriend and his friends from the track team stood outside, sweating in the humidity, surveying it. If only they had some roofing tarp, they said.

The boys went to Home Depot. We recruited an old mattress as a splashdown pad. When a hundred yards of thick tarp were splayed down the hill, we smothered it in dish soap and waited for the swollen clouds to let loose again. The rain began, and the track stars, one after another, sprinted across the parking lot to launch themselves onto the slide.

The lightning flashed off our Solo cups. Stop signs wagged in the wind. The rain came harder, which made our slide slicker. People began to slip off the tarp too early and race across the lawn on their backs. There were grass burns. Someone did a backflip. One of the runners cut a foot on a previously lost (now found!) wineglass. We were not safe, but safety, we decided, was not so important. We had all the supplies we needed to survive right inside the apartment. What we had found was something to survive *for*.

—*Jacqueline Detwiler*



Last July, a Russian helicopter pilot had nearly completed a record-breaking trip around the globe when he crashed into the icy waters of the Arctic Circle.

Stuck on a slab of ice surrounded by polar bears, with only a handful of protein tablets, a half-liter of water, and his GPS trackers lost at the bottom of the sea, he never should have survived.

By **JUSTIN NOBEL**

Photograph by **ALEXANDER GRONSKY**

MAROONED IN THE ARCTIC (WITH POLAR BEARS)

Sergey Ananov photographed in Moscow on November 30, 2015.

The pounding noise shatters the ancient, eerie silence of the Davis Strait, a frigid finger of ocean separating Canada and Greenland. ¶ *Thwick-thwack, thwick-thwack, thwick-thwack.* ¶ It comes from above but the marine fog is thick, the source invisible. The sound gets closer, louder. ¶ *THWICK-THWACK, THWICK-THWACK, THWICK-THWACK.* ¶ The pilot wears an old red neoprene survival suit. But it's hot in the helicopter, and the bulky outfit's mittens make it difficult to operate the cyclic stick. After forty-two days, twenty-one thousand miles, and three continents, he sometimes has to relax a little. So he is bare-chested, with the suit unzipped to his waist, when the sputtering begins. The helicopter is not big: a plucky 880-pound Robinson R22 that maxes out at 117 mph. The pilot knows every inch, every bolt. He has been flying R22s for years. He knows what the sputtering likely means: A belt transferring power from the engine to the rudder blades has just snapped. He also knows what comes next.

Manifold pressure increases. Speed decreases. The helicopter is going down. The pilot switches to autorotation, a safety mode that allows the craft to glide downward. From a height of three thousand feet, it falls through the fog at a rate of roughly seventeen feet per second. But falling where? It isn't until two hundred feet above the partially frozen sea, barely enough time to maneuver, that the helicopter pierces the fog. The pilot aims for an ice floe about the size of a basketball court. In a few seconds he realizes he won't make it, so he expertly tilts the helicopter for safest impact and lands the skids smoothly on the water.

The pilot knows the blades could accidentally chop off his head when he climbs out of the craft. By leaning his weight to the left, he tips the helicopter in order to smash the blades to pieces against the sea. This kills the engine, but now, tail-first, the machine starts to sink. Fast.

Freezing water floods the cockpit, wrapping around his naked chest, rushing down the legs of the unzipped survival suit. His gear begins to float—plastic fuel tanks, a small bag of clothes—but the most crucial items are suction-cupped to the windshield: two GPS trackers, one distress beacon, and a satellite phone. Somewhere beneath the seat there is also a deflated life raft containing a survival kit with three flares, a half-liter of water, and a tiny box of protein tablets.

Almost instantly, the pilot is submerged to the neck. There is only time to save one thing: satellite phone, distress beacon, GPS tracker, or life raft. The phone can call for help. The beacon and GPS tracker can give rescuers a chance to actually find him. But none of those do much good if he can't stay afloat.

He reaches under the seat to grab the raft, but it is stuck, and the cockpit is so cramped that he can't get enough leverage to yank it free. He swims out the door, takes a deep breath, then dives back under and into the submerged helicopter. The water is black and salty and cold—35 degrees Fahrenheit. It is difficult to keep his eyes open. But he must find the raft. It has floated out from under the seat and become tangled in the seat belt. He unsnares it, swims to the surface, and greedily gulps air.

Once he catches his breath, he begins swimming to the closest ice floe, the one he tried to land on—160 feet away. The life raft weighs about twenty pounds. The pilot clutches it above his head with one hand and paws at the water with the other. He propels his five-eleven, 176-pound frame, now weighted down by the waterlogged suit, through the waves. Each stroke gets him closer, yet sucks even more water into the suit, further yanking him down. Killer whales and the elusive Greenland shark hunt these waters, but none of this is on his mind. He is single-minded: Make it to the ice floe.

After three grueling minutes, he does. But this ice is two feet thick, radiant blue, pitted and roughened by at least two years of melting and refreezing. The weight of the suit makes it impossible to hurl his legs over the jagged lip. Yet he keeps trying, searching for the right spot at which to hoist himself up, like a toddler trying to climb out of the deep end of the pool. The sharp ice scrapes away skin. Blood runs down his forearms and into the sea. He finds a smooth section, presses his bare chest flat against the ice, uses his nails as claws, and shimmies atop.

Every inch of him is soaked, and his chest is now exposed to the biting wind. He shivers violently, an automatic response intended to generate heat. His shaking hands struggle to peel off the suit, its neoprene material clinging stubbornly to his skin. Once it is off, he flaps the suit up and down, trying to wring out the water. And it is then, fifteen minutes since the belt snapped, as he stands on the ice floe in nothing but his running shoes and underwear, that the situation becomes clear.

Sergey Ananov is trapped on a slab of ice in the Arctic Circle. He has no locator beacon, no phone, and barely any water. The fog will hide him from any rescuers. Night will come. Hypothermia will come. And whatever large, powerful creatures that scratch out their existence in this primordial world—maybe they will come too.

His eyes wander past the ice and over the roiling open waters of Davis Strait. He is alone, and with each minute that passes he will drift farther from the spot where the helicopter went down, lessening the chance he will ever be found.

PHOTOGRAPH BY BEN GOLDSTEIN

The world has been trampled over and clambered up and submarined down, but if man searches hard enough he can still find a remote and dangerous front on which to battle nature. There are still records to be had. You can still be first at something, the way Hillary and Shackleton and Yeager were, and the way Musk and Branson and Bezos want to be. The allure for these men is that simple: the desire to be recorded as the first human to try something, and to succeed at it. Immortality. Who doesn't want his name to live forever?

Back on June 13, 2015, the day his Robinson R22 lifted off from the airfield at Shevlino, Russia, about twenty miles from Moscow, the fifty-year-old Ananov was the head of a Moscow trash-and-recycling company. He had already set five world aviation records in the R22 but nothing as ambitious as this: becoming the first person to fly alone around the world in a helicopter weighing less than one metric ton—approximately 2,205 pounds, more than twice the weight of the R22.

According to the Switzerland-based Fédération Aéronautique Internationale, the group that keeps track of world aviation records, there has been only one successful around-the-world solo helicopter flight. But that flight was in a heavier craft, and the pilot had support aircraft trailing him, packed with spare parts and extra fuel. The R22 is intended for activities like flight training, mustering livestock, and patrolling pipelines—not circumnavigating the globe. And except for a couple of friends tracking his progress online in the event of an emergency, Ananov was doing it alone. This would be the record to put him among the legends.

He began by crossing Siberia into Alaska, flew south through the western United States, then zigzagged across the American heartland. Since no one had ever achieved such a mad record, there was no time to beat. But Ananov didn't want his trip to look like the leisurely jaunt of a dilettante. He began his days at dawn and often landed in the dark, averaging about 435 miles a flight and sometimes topping 600 miles. He refueled at local and regional airfields. He ate mainly fast food—hamburgers, pizza, KFC—and slept in cheap hotels.

Ananov got to know America, staying the night in outposts like Sidney, Montana, and Guntersville, Alabama. The people were friendly—some of them gave him fuel. The R22 holds about twenty-nine gallons, and in two large plastic jerricans kept beside him in the passenger seat—along with his small bag of clothes, chocolate bars, and the occasional leftover hamburger—Ananov could carry another twenty-nine gallons. An electric pump allowed him to transfer this fuel into his main tank as he flew.

He entered Canada near Montreal, traversed remote Quebec, and crossed the Hudson Strait to Iqaluit, capital of the Inuit territory of Nunavut. It was from here that he took off that morning of day forty-two—less than three thousand miles from home and certain glory.

Now, stranded and shivering, he allows a few minutes to beat himself up for his mistakes. If only he had dived down into the freezing water once more and retrieved one of the GPS trackers or the distress beacon! If only he had managed to land on the ice floe in the first place! He could somehow have hailed a mechanic to fix the R22 and still captured the record! But none of this matters now. It is wasted energy to even think these thoughts. And so he gets to work.

First he must get the survival suit back on. He can't wring out all the water, and he struggles into the dank neoprene, pulling it up all the way so the built-in cap covers his head. He now has a thick layer between him and the wind, but that layer is soaked, and his body continues to shiver. The suit's mittens have reduced his hands to clumsy paws, and he fumbles with the cord to blow up the life raft. After several yanks, the raft inflates. He takes the cord and ties it to his leg, so the raft won't blow away. Using it as a windshield, Ananov lies beneath, flat on his stomach.

This is not the teeth-chattering cold of spending too long on a ski slope. This is the cold of gangrene and cardiac arrest and brain death. This is the cold of hypothermia. Ananov gets up and tries to walk around his ice island, dragging the raft behind him, but he is quickly panting. Nerve and muscle fibers don't work so well in the cold, as the chemical reactions that enable their functioning slow down drastically. Because of the shivering, his muscles are continuously contracting. There is also the wind—cold and unbearable. He figures the most helpful thing he can do right now is nothing: simply keep as still as possible and try to retain heat and energy. He lies back down under the raft.

Ananov in the Robinson R22 during his record-setting attempt.

About three thousand miles away, in San Francisco, a Russian-American friend of Ananov's named Andrey Kaplin is one of those tracking the journey online. They connected on a Russian Web forum for private pilots, and first met just weeks ago when Ananov passed through on his journey. Kaplin sees that one of the GPS trackers indicates the helicopter's speed has flatlined. He makes a call to another of their pilot friends in Moscow, Michael Farickh. It is the middle of the night there, but Farickh jumps out of bed and makes the call that counts: to the Joint Rescue Coordination Centre in Halifax, Nova Scotia.

Halifax dispatches two C-130 Hercules aircraft to the pilot's last known position. But it is too late in the day for a thorough search. Halifax also radios the *Pierre Radisson,* a 323-foot Canadian Coast Guard icebreaker commanded by Captain Stéphane Julien. Though here too, a snag. The vessel is at least a day away, in Frobisher Bay, escorting a freighter into Iqaluit. With no other icebreakers in the area, Captain Julien cannot abandon his charge.

But Julien knows how dire the situation is for Ananov. He became fascinated with the Arctic at six years old, watching Super 8 films of polar bears and ice floes with his uncle, who sailed with the Canadian Coast Guard in the 1960s. At seventeen, Julien signed up, and by 2003 he was commanding a medium-class icebreaker used for research. From polar scientists and Inuit guides, Julien has learned the Arctic's secrets. He has done twenty-nine Arctic tours, sailed the Northwest Passage seven times, rescued several human beings from an icy death. He decides he will not let the stranded pilot perish. Safely depositing the freighter in Iqaluit, he battles back through the treacherous passage he has just traveled and heads for the Davis Strait.

Ananov knows none of this—and hopes only that the GPS trackers, waterproof to one meter, somehow communicated his desperate situation before sinking six hundred feet to the sea bottom. Or that the buoyant distress beacon became unsuctioned from the helicopter's windshield and bobbed to the surface. He also knows nothing of the predator now tracking him. For somewhere in the strait, one of earth's great hunters has stood upright and is waving its head back and forth. It can smell a ringed seal under several feet of snow and a rotting whale carcass from ninety miles away. But this scent? It draws a blank, having never encountered a middle-aged Russian—a 176-pound salami on an ice floe. Moving in its pigeon-toed walk, swinging its front paws out with each step then turning them inwards and landing heels first, the polar bear heads off to inspect.

The summer before, in nearby Arctic Bay, thirty-one-year-old Adrian Arnauyumayuq and his twenty-six-year-old brother-in-law loaded up a snowmobile and ventured out on their annual hunting trip. The first night, they set up camp on an ice floe, a few hundred feet from the edge. In the morning, they were wakened by a thousand-pound polar bear ripping apart their tent. Arnauyumayuq quickly reached for his three-inch hunting knife, stabbed the bear in the face, and then tried to flee the tent. But the bear pounced on him, clawing open his back and gobbling his head.

"I could see inside its mouth," Arnauyumayuq later told the local newspaper *Nunatsiaq News.* "It was all black and smelly."

The bear flung Arnauyumayuq aside and went after his brother-in-law, fracturing his collarbone before Arnauyumayuq could grab his rifle and shoot the bear dead.

The Arctic is full of these kinds of stories. They blow around in the wind, drift with the tide. It has always been this way, ever since the Tuniit people arrived five thousand years ago with bows and arrows. Mostly these stories end not in survival but disaster.

Sergey Ananov has no rifle. He has no knife. About four hours after falling out of the sky, he is still on his stomach inside his makeshift tent when he hears the sound of heavy breathing and crunching snow. He peeks out from under the raft and sees the bear, its fur wet and glistening after swimming from floe to floe—a task it can do for days without stopping.

Ananov hides beneath his raft and hopes the monster leaves. It doesn't. The creature bobs its snout up and down, sniffing the air, and lopes straight for him. The bear is about five feet away, so close that Ananov can see the black of its footpads and toenails. Biologists will tell you that at this point the bear has one of two motives: hunger or curiosity. Both are bad for the pilot since polar bears often satisfy their curiosity with their teeth.

If I meet the bear face-to-face I will die, Ananov thinks. And that death seems imminent, guaranteed. Then, from somewhere deep in his core, a primeval and spontaneous urge is unleashed. Ananov bolts up, flings off the raft, and rushes the beast—his arms flailing, roaring as loud as he can. And it works! The bear actually gallops away. But Ananov does not stop. He chases the bear to the very edge of the floe, with the raft still attached to his leg and bouncing behind him. The bear nimbly launches across to a neighboring slab, then looks back at Ananov, who continues to scream furiously. His eyes are black coals of rage. He is roaring. The bear jogs a bit, sits down on his backside, and looks right at the pilot, examining him mutely. Ananov still roars. But now it is not only directed at the bear. It is directed at the cruel fate that put him here. It is directed at his utter helplessness.

For a full minute, the strange encounter continues. Man roaring, beast watching. Then the bemused bear gets up and trots off into the Arctic fog.

The euphoria and adrenaline from the encounter with the bear do not last. The hours lumber on, minutes that feel like years. Then the sound of a plane.

Ananov cannot see it because of the fog, but with his clumsy mitts he seizes one of the three flares, aims it at the noise and pulls the cord. A dazzling orange-red flame leaps into the air. Ananov hears the plane arc directly overhead and continue on.

Top: The Canadian icebreaker *Pierre Radisson,* which led the search. Above: The ship's crew members pose with Ananov (seated at center).

The flare burns for thirty seconds, then fizzles.

Evening approaches. The cold is deep, raw, gnawing. The temperature is hovering right at the freezing point. Ananov rations his protein tablets, about two thousand calories' worth, into three-day portions. After that, he figures, he will be dead.

Humans can go without food for more than three weeks—so long as they have water. Ananov has only the half-liter that came with the raft. His shivering is so fierce and constant that it causes him to sweat. He has also been urinating frequently in the survival suit—a liberating release that provides brief moments of warmth and happiness. He is losing water simply from breathing. If all this bodily fluid is not replenished, the corresponding drop in blood pressure will be fatal. It seems a bit of cosmic ridicule: quite literally dying of thirst while surrounded by water and even sitting atop the stuff, yet unable to drink a drop of it. Ingesting saltwater would only speed up the dehydration.

Ananov does not sleep. He listens for bears. He thinks about his wife, Jane, and his children. His twenty-two-year-old daughter, Daria, has just graduated with a degree in journalism from Moscow State University. His twenty-year-old son, Andrey, is studying economics at Moscow State Institute of International Relations. At least they are grown, Ananov thinks. And thanks to the trash business, at least they will be taken care of.

About a hundred miles away, the *Pierre Radisson* finally reaches a section of open water and Captain Julien fires all six engines, 40,000 horsepower in total, plowing forward at the ship's top speed: nineteen miles per hour.

In the morning, another plane. It is still too foggy to see the craft but Ananov, hopeful, lights his second flare. No luck. However, the still-hot flare casing does him some good: He uses it to burn holes in his survival suit at the tip of each foot. Now the urine that has been pooling in the feet and legs of the suit can drain directly onto the ice. The small things that enable man to survive.

Later that same morning, Ananov hears a helicopter. It is at least a few miles away. Ananov knows there is no way the pilot will be able to see the minuscule twelve-inch flame. So he decides to save his last flare. The helicopter disappears.

Then another bear. Again Ananov flails, roars, chases the beast, scampers across the ice screaming like a fool. It works again, but without food and sapped by the constant shivering—the only thing keeping his body warm enough to function—he is even more worn-out than the first time.

Morning passes into afternoon. There is a depression in the ice near the floe's edge filled with dazzling aquamarine water. Ananov sets his life raft down, creating a sort of water bed. He lies down and dozes, memories spinning backward, until he hears the familiar crunch of snow.

A *third* bear walks toward him, sniffing the air with its massive snout, smelling the human body beneath the neoprene fabric, a body that is weakening, ripening. Ananov scares it off in the same manner, staggers back to the raft. He flips it over and crawls beneath.

He does not have the energy to fight off another bear, or he tells himself he doesn't. He has never thought of suicide before. But when we humans find ourselves in desperate situations, perspective—our unique ability to view our own situation within the full context of human suffering—has a way of disappearing. Time collapses in on itself. The power to think clearly, the way we would back home, where everything is okay, becomes a vital piece of equipment to be preserved at all costs. Being marooned in the icy brutality of the Arctic has rendered Ananov's mind a gelid mass of fear and uncertainty. He does not want to be devoured and digested by a polar bear. He would rather die on his own terms. As he shivers violently on the ice, he contemplates how he might execute the task.

Twenty-five hours after leaving the freighter, fighting a one-knot current and narrowly avoiding twenty-story icebergs and submerged ice hunks called growlers, the *Pierre Radisson* chugs into the ice-floe-flecked region of the Davis Strait where Ananov went down. Halifax has drawn up a plan based on Ananov's last beacon point, the wind, and the weather. But the wind is light, and Julien suspects their calculations are off. Instead of beginning the search eight miles from the beacon, as Halifax proposes, he focuses on a two-mile radius.

A *THIRD* POLAR BEAR WALKS TOWARD HIM, SNIFFING THE AIR, SMELLING THE HUMAN BODY BENEATH THE NEOPRENE SUIT.

All available hands are on deck. The mood is tense. In a few hours it will be dark, making a rescue impossible, leaving Ananov to spend another night on the ice. He might not make it. He already may not have made it—not all of him, anyway. The overnight low could drop below freezing. And that is without the windchill. In such conditions, frostbite can occur in as little as thirty minutes. And even if he does make it, by tomorrow his body will have diverted most of its blood from the brain and other organs to the heart, leading to confusion, lethargy, slurred speech—a revived infancy that will slowly, inevitably fade to black. Loss of consciousness, coma, death.

Then, miraculously, the fog lifts. And in that moment, as the sun magnificently sets across the Davis Strait, the brutality of the Arctic also evaporates. In that moment, there is no more beautiful and peaceful place on earth.

Captain Julien calls Halifax to convey the suddenly favorable conditions, but their planes are more than two hundred miles away in Iqaluit and won't be heading out again until morning. There is one hour of light left. Again acting on a hunch, Julien orders a GC-366 helicopter with two observers into the air. Back on the bridge, a third lieutenant spots a red light on the ice surface.

Julien takes a compass bearing and steers toward the point. The rescue helicopter is notified. They spot the final splinter of light from Ananov's last flare. They spot Ananov. There are no bears on the floe but he is once more running and waving and screaming.

That night aboard the *Pierre Radisson,* thirty-six hours after the R22 hit the ocean, the pilot is fed salad with olive oil and freshly smoked salmon. Everyone wants to shake his hand and take a photo. He obliges, even though this is not anything like the adulation he was looking for. This is not how he wants his name to live on. This is an insufficient immortality.

As he smiles for the camera phones, he is already thinking about the new R22 he will buy. He is already thinking about how he will pack it differently—the emergency equipment, everything within reach. And he is thinking about next summer, when he will once again lift the helicopter into the sky and point it in the direction of the other side of the world. PM

THE CABIN

To build a house for his family, the author felled the trees, milled the lumber, and drove the nails. A story about shelter, memories, and the endurance of friendship.

BY BEN HEWITT

PHOTOGRAPHS BY DYLAN GRIFFIN

The author nails shiplap sheathing on a gable end. His plan was to build a house and barn in only six months.

NOVEMBER 2015

THE SAWMILL IS QUIET. It rests on a patch of fallow ground at the fringe of our woodlot, the gas drained, the engine covered with a heavy tarp to protect it from inclement weather and nesting mice, the battery removed and placed on a trickle charger. I should pull the blade too. Hang it in the barn so it doesn't rust. But I haven't yet. I've been busy.

The sawmill used to belong to my best friend, Jim. Five years ago, at the age of forty-three, he died in his sleep. Heart failure. This happened without warning, a mere two weeks before he and his wife were to adopt newborn twin girls. It had taken them years to line up this adoption. They'd come close to becoming parents before, to babies that, for one reason or another, had become unavailable at some heart-wrenching last minute. But they'd never come this close. They had a stroller. They had a crib. They even had diapers. This time, it was going to happen.

Shortly after his death, Jim's wife gave us his sawmill, the very mill he'd used to build the house that sits a hundred or so feet from where we buried him, the heavy shovelfuls of clay soil thumping with almost metronomic rhythm against the simple pine coffin. Two weeks later, I sat at the hospital with his family, waiting for his children to be born. His widowed wife was determined to follow through with the adoption.

Jim and I had known each other since high school. We'd been close then, and we'd remained close over the years, bonding first over our shared affection for too-fast motorcycles and classic Rush and later over the pleasure we derived from home projects. Jim had helped my wife, Penny, and me build our first house, and we'd helped him with his, and I think everyone understood that Penny and I got the better end of that deal. Not only was Jim exponentially more skilled than us, the guy had more tools than a Home Depot.

In adulthood, Jim and I came to embody some very fundamental differences. He became a strict vegetarian, while I am a connoisseur of animal flesh, raising and personally slaughtering my family's meat. He was meticulously neat and methodical, whereas I am chronically disorganized and almost allergic to forethought. He attended church regularly, while I can sort of remember squirming through a sermon during a visit to my grandparents' when I was six.

But our friendship thrived in the manner many of the best friendships do—in some ways despite itself. When my oldest son was born, Jim was the first person other than Penny and me to hold him. Our second son took his first steps with his soft fist enclosed in Jim's big, work-calloused hand. Everywhere I look in our house, there is evidence of Jim. The door we built together. The solar panels we installed. The drywall we hung. In the days following his death, I remember thinking that there was not a place on our property I could cast my gaze and not be reminded of him. This was excruciatingly hard. It was also wonderful.

I think of Jim frequently, maybe even every day. The mill is a reminder, of course, but so are many other things: a Rush song coming on the radio, a rare sighting of one of those funny little low-slung Pontiac Fieros like the one he owned in high school, the same one we spent hours in, driving too fast, the heavy bass lines from *2112* thrumming in our ears. Even this project. He would've loved this project. He would've been here helping all the time.

SEPTEMBER 2015

WE DECIDE TO insulate the upstairs of the barn. This wasn't part of the original plan—or the original budget—but we're drastically behind schedule. This will benefit us twofold, first by providing a warm, if rustic, space to reside while we finish the house, and second by serving as a heated workshop once we're ensconced in the house. It will add a few thousand dollars to our overall expenditure, which is no trifling detail, considering that our total budget for house and barn is less than $100,000. We make a conscious decision not to dwell on the sad fact of this unanticipated expense and resolve to scrimp in other areas. This is made much easier by the simple fact that at this point we essentially have no choice.

JULY 2015

BY THE MIDDLE OF the summer, at least one thing is abundantly clear: At the pace we're on, there's no chance we'll have a habitable house by the end of October, when we need to be out of our current home. This is entirely our fault. In a fit of outrageous optimism and an inflated sense of our own capacities, we'd actually started with the barn, so that we'd have a roof under which to store the hay we'd need for our small herd of cows by the time it came off the field. In this regard, at least, we can claim success, but now we realize just how audacious our original plan was. Build a barn and a house in just six months? And saw the lumber? It suddenly seemed outrageous.

What's more, with the barn finished, I am now enlightened as to just how much lumber it's going to take to build the house, a measure I've bestowed with the technical moniker *shit-ton*. Sure, I'd run some numbers and made some calculations, and according to my crude math, I'd sawed more than enough to at least frame both structures. But math is only as good as the numbers that go into it, and my numbers are off by at least a quarter shit-ton, if not more. For instance, I'd failed to include the horizontal nailers for the barn sheathing. And I hadn't anticipated the sheer quantity of jack-and-cripple studs necessary to frame the window and door openings in both the barn and house. An entirely predictable thing has happened: The towering stacks of lumber we started with have shrunk with alarming rapidity, as if they'd been hewn of ice and are now melting under the high summer sun. I try to compensate by sawing at the fringes of each day, often making studs before breakfast that become walls by dinner. I know this is not ideal—building with green lumber never is—but it is necessary.

I felt a lingering sense of obligation to my departed friend. This was ridiculous, and I knew it. Jim wouldn't have thought one iota less of me if I'd thrown in the towel and ordered up a modular home.

I have to come to terms with the fact that I'm not going to be able to saw as much lumber as anticipated. I'd never expected to mill every last stick. For instance, we had long planned to use tongue-and-groove paneling on the interior walls, the making of which necessitates specialized milling equipment. But I'd been certain I could at least pull off the simple rough framing and sheathing materials.

"I'm not going to make it," I tell Penny early one morning. This is a crushing realization for me. The plan had seemed so tidy, and what's more, I'd been running my mouth to anyone who'd listen that we were going to build a house with our own lumber. I really liked how it sounded when I said it. This was still technically true, of course. We *were* building with our own lumber. But as I watched the ratio of homegrown to purchased lumber shift inexorably, I began to feel as if I were somehow fibbing. Furthermore, I felt a lingering sense of obligation to my departed

Opposite: Harvesting logs from his property in Vermont. Clockwise from top: Most residents of the region build their homes; after his best friend died in his sleep at forty-three, Ben Hewitt inherited the sawmill he used to mill his own lumber; felling a balsam fir.

Almost everyone we know has built or someday plans to build their house with their own hands. This DIY ethos is due, in part, to simple economics and also, I think, an ingrained sense of Yankee thrift. It's as if hiring someone to build your house were somehow a display of excess.

friend. This was ridiculous, and I knew it: Jim was one of the least judgmental people I've ever known, and wouldn't have thought one iota less of me if I'd thrown in the towel and ordered up a modular home with steel studs and vinyl siding. But I couldn't quite shake the sense that I was letting him down.

In the end, I was able to produce approximately 50 percent of our total lumber needs. I purchased the remainder from two local, family-owned mills at shockingly reasonable prices. It wasn't without pride that I noticed that the quality of my homegrown lumber compared favorably with that of more experienced sawyers, at the helm of exponentially more capable and expensive sawmills.

FEBRUARY 2015

I TRUDGE BACK TO the house, sputtering and cursing, my brow beaded with sweat despite the single-digit temperatures. We're in the midst of a historically cold and snowy northern Vermont winter, and I've gotten the tractor stuck yet again, the machine's big lugged tires rendered impotent in the three feet of accumulated snow. "Stuck?" Penny asks, before I've even closed the front door behind me. I just nod, shucking boots and insulated overalls. My fingers are painfully chilled from the half hour I spent pawing uselessly at the snow in a feeble attempt to extricate the tractor, so I hover my hands a few inches above the hot iron of the woodstove, saying nothing. Penny says nothing too. She's smart like that.

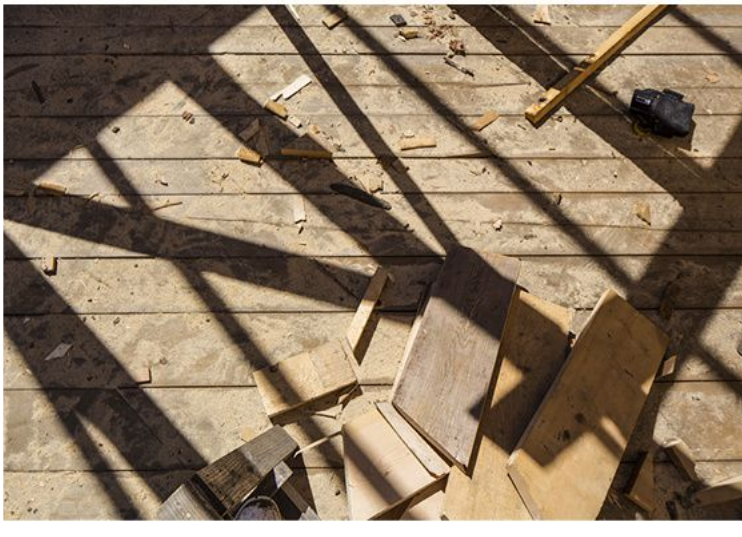
Earlier in the day I'd warmed up the sawmill, filled the tank, and swept the bed clean in preparation for the logs I planned to pull from the woods—fat, arrow-straight lengths of balsam fir, sawed into sixteen-foot lengths from trees I'd felled two weeks prior. This was before yet another in a long series of storms covered my skid path, making it difficult to discern where the tractor would find solid footing along the previously traveled route, and where it would flounder.

The plan was to saw enough lumber over the winter to build my family and myself a small barn and an even smaller house, situated on a hundred mostly wooded acres just off a little-traveled gravel road in the northeastern quadrant of Vermont, known colloquially as the Northeast Kingdom. Fourteen hundred square feet for the barn, another eleven hundred for the house. Used windows, old doors, roofs of simple screw-down metal—modest structures, befitting budget, taste, and skills. These buildings would not soar, nor astonish with displays of old-world craftsmanship. They would be simple but sound, built by our hands and those of friends. Crucially, they would be unencumbered by debt. We would own the structures materially, but also familiarly, knowing them inside and out. Every stud, every joist, every rafter, every last nail and screw.

That was the plan, and in our rural, working-class community of cash-strapped, skills-rich men and women, it is hardly unusual. Almost everyone we know has built or someday plans to build their house with their own hands. This DIY ethos is due, in part, to simple economics and also, I think, an ingrained sense of Yankee thrift. It's as if hiring someone to build your house were somehow a display of excess.

Still, as I defrost my aching hands over

Left: Ben (left) and his wife with a neighbor, one of the many self-reliant residents of Vermont's Northeast Kingdom. Right: Half of the project's lumber was milled by hand. Opposite: While the finishing touches were put on the house, the author and his family lived in the barn.



the woodstove on this frigid February morning, I begin to grudgingly accept that the plan might soon come up for revision. Thus far, I've sawed about five thousand board feet of lumber. It is a good amount, to be sure, comprising head-high stacks containing hundreds of 2 x 6s and 2 x 10s. It is also maybe 20 percent of our total lumber needs, and the building season is fast approaching. I need to get the tractor unstuck pronto.

I take some solace from my belief that at least I have a sense of what to expect once the building begins in earnest. Penny and I had built one house already—the one we currently occupy—and, in defiance of every cliché ever uttered about building with your romantic partner, we had actually enjoyed the process, despite our first son being born into the chaotic midst of construction. (Penny went into labor at the lumberyard.) The prospect of building another house didn't feel as much like a burden as an opportunity. An opportunity to build smarter, smaller, simpler. An opportunity to start with a clean slate, to improve upon the myriad errors of our first effort. And this time, thanks to Jim's sawmill, we could build with lumber milled by our own hands.

MAY 2011

I MILL MY FIRST STICK of lumber shortly after Jim dies. Like most of the lumber I would eventually mill, it is from a log of balsam fir and redolent of a certain earthy sweetness I soon come to associate with freshly sawn lumber. It feels cool and just a little prickly in my hands. I hold it for a few seconds longer than strictly necessary, a little stunned to realize that less than an hour before the tree had stood tall among a dense copse of its own kind, stretching skyward for twenty-five yards or more, a good sixteen inches across.

I'd been the architect of this tree's demise, dropped it hard and fast to the ground with the brutal efficiency inherent in a 65-cc chainsaw, and in truth this made me feel a little sad. But I'd also been the architect of its transformation from standing timber to functional lumber, ushered it through a door into the realm of human usefulness, and this makes me feel both happy and competent. It's a potent, addictive combination.

From a technical standpoint, it's really not that hard to mill your own lumber. Of course, there are certain risks to be mindful of, particularly during the tree-felling stage. But assuming proper technique and a modicum of common sense, it's possible to produce lumber to a high standard with only a few hours' practice. After a summer of mill ownership, sawing intermittently, I would find that I could produce somewhere on the order of a thousand board feet in a long day. Around here, that's about $600 worth of lumber, which sounds like a decent payday—until you consider the time spent harvesting the logs and the investment in machinery (in my case, chainsaw, tractor, and winch). But efficiency increases with repetition. At least, that is my hope.

OCTOBER 1998

PHASE ONE OF OUR first house—a simple, two-story 16 x 32 cabin we'll eventually add onto—is nearly habitable. Habitable is not the same as finished, as evidenced by the exposed insulation, the aluminum ladder that serves as stairs, and the lack of a front door. Penny and I lived in the doorless structure for the entire summer, hanging a blanket over the opening to thwart the worst of the biting insects and then, as the season turned, the chill night air. But "chill night air" means one thing in October and another in December, which no longer seems very far away.

Jim stops by to help with the door on a too-warm afternoon, one of those halcyon autumn days in Vermont that can almost make you forget winter will ever arrive. We set up on the living room floor: lumber, glue, clamps, saw, drills, screws. It will be a simple door, a minor project, little more than tongue-and-groove planks screwed into a frame to hold them true. But we're not looking for high-end craftsmanship today; we're looking for a weather break on hinges.

As always, Jim and I fall into a comfortable rhythm. We've worked together so much that it sometimes seems as if we become extensions of one another, able to anticipate the other's needs almost before he does. A tool at the ready, or a measurement taken and cut line scribed before the question is even posed. We chat and laugh in the quieter moments between the clamor of saw and drill. The low sun streams through our untrimmed, southwest-facing windows.

By the time the sun has sunk below the mountains to our west, the door is built. We remove the blanket and hang the door in the rough opening, working in the waning half-light of dusk. There are no stops yet, no latch to keep it closed. I'll add those later.

Jim stays for dinner. We always eat together before, during, or after work. The two of us sit on the sill of our just-made door, the air going cool around us, plates of food on our laps. The late-day sun slants across our faces. It feels good. PM

THE ICE MEN

BY
TIM HEFFERNAN

PHOTOGRAPHS BY
RICKY RHODES

MARCH
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2016

WHEN THE GREAT LAKES FREEZE OVER EACH WINTER, THE $33.5 BILLION SHIPPING BUSINESS THAT SUPPLIES THE REGION'S INDUSTRIAL CENTERS LOOKS TO A SMALL FLEET OF STALWART COAST GUARD SHIPS AND THEIR SEASONED CREWS TO KEEP AMERICA'S HEARTLAND MOVING.

The oil/chemical tanker *Algocanada* makes its way through ice broken by *Katmai Bay*.

LIEUTENANT MIKE PATTERSON, commanding officer of the U.S. Coast Guard icebreaker *Katmai Bay,* took in the frozen scene from the wheelhouse of his ship. Out the windows, freighters pointing up- and downriver stood still. The little ferry to Sugar Island was trapped in port and calling for help. None of them looked like they'd be moving anytime soon: The St. Marys River was iced up.

The ice had moved in overnight. It blew south out of Lake Superior and piled up in Whitefish Bay, then slid out of the bay and into the St. Marys. In blocks and bergs it tumbled down the rapids and through the stone raceways of the Soo Locks. Then, two miles below the locks, where the river funnels into a narrow channel called Little Rapids Cut, the ice got stuck. It piled on top of itself, jammed tight, and turned the smooth-running black water of the river into the jagged white parking lot that was stalling the freighters and ferries.

"Good," Patterson said. "This is exactly what we want to see."

Katmai Bay is based in Sault Ste. Marie ("Soo Saint Muh-REE"), Michigan—350 miles due north of Detroit across the St. Marys from Canada. All told, the U.S. Coast Guard operates nine icebreakers on the Great Lakes. The American industrial centers of Detroit, Chicago, Cleveland, and Milwaukee line the shores and rivers of Huron, Erie, Superior, Michigan, and Ontario, and their mountains of ore, coal, steel, and grain mostly come and go by ship. Beginning in mid-December, the lakes begin to freeze over. If the ice gets too thick, the ships stop, and if the ships stop, a big chunk of the

The 140-foot *Katmai Bay,* at dock in Sault Ste. Marie, has been breaking ice since its launch in 1978.

From left: *Katmai Bay*'s twin 2,500-hp engines; a view into the wheelhouse; crew members take a break in the galley between passes breaking ice; even with GPS and radar, the crew still count on analog equipment as backup.

economy stops. Someone has to keep it moving. Despite five-month winters and subzero temperatures, Coasties volunteer to serve here and break the ice year after year.

Patterson, who has broken ice for five winters and is based at Coast Guard headquarters in Washington, D.C., ordered *Katmai Bay* into action. From the pier in Sault Ste. Marie, the crew of sixteen revved up the ship's twin 2,500-hp Fairbanks Morse diesel engines to deliver maximum torque to *Katmai Bay*'s eight-foot-diameter propeller. Her bow lifted above the water and her stern sank into the hole the propeller was churning in the river. *Katmai Bay* kicked in seconds from a dead stop to near her top speed of fourteen knots—not exactly Ferrari-like, but more than enough to knock a greenhorn on his butt. The crew, though, all of them veterans of at least one full winter aboard the *Katmai Bay,* didn't even reach for handholds as the helmsman turned her toward the ice in a tight, smooth arc, straightening just before she hit.

The impact hardly registered to those aboard. But the ice below scattered like a clowder of frightened cats. Chunks the size of milk crates pinged off the inch-thick steel hull and rolled away in the wake, grinding together like huge teeth. Table-sized plates of ice, a foot thick or more, splintered against the bow. Some pieces got sucked into the prop and exploded out with wet bangs. Whipping the ship's wheel back and forth as if he were driving slalom in a BMW, the helmsman made *Katmai Bay*'s rudder swing left and right, or sally. She rolled violently side to side, sending huge waves shoreward, shaking up the locked ice as she went.

Katmai Bay spent two hours running a half dozen loops through the ice pack, a maneuver called racetracking. The goal wasn't to plow open a channel through Little Rapids Cut, but something more strategic: to loosen the traffic jam of ice just enough to let the river do the hard work of carrying it away.

A lot of ice breaking works like that. It's as much about outthinking the ice as outmuscling it. After Little Rapids Cut, Patterson ordered *Katmai Bay* farther downriver to where the St. Marys widens to more than a mile. Here the shipping channel had become a narrow strip of water surrounded by vast prairies of fast ice, solid ice frozen to the river bottom or shore. But it was only wide enough to let a single ship pass. The last thing Patterson wanted to do was break off a huge piece of ice and have it jam the channel, so he directed the helmsman to "scarf the edge"—shave down the lip of ice with the ship's hull.

It's tricky work, scarfing. *Katmai Bay* may seem like a floating bulldozer—implacable force, unbending steel—but, as you try to carve a straight line down the edge of the ice, the ice keeps flicking all 662 tons of the ship back into the channel. Try to swing back in, and the tail slips out from beneath you and the ship slides out into the soft water. Steering *Katmai Bay* then is done more by feel than by thought, like riding a surfboard. The trick isn't brute force. It's balancing your force against nature's.

Still, you do need muscle. The Great Lakes experience some of the worst winter conditions in the country: The freezing temperatures and arctic storms can produce ice five feet thick—and twice that where drifting sheets crash and form pressure ridges in the same way that mountains rise at tectonic seams. Last April, the Coast Guard's heaviest icebreaker, *Mackinaw,* was put out of commission when one of its propulsion units was holed by the ice and a seal started leaking. Though, as one crewman fairly pointed out, "If you beat the piss out of [a ship] for seven years, you can't really complain."

Last winter, *Katmai Bay* ended up working until early May. The one before that, in 2013 to 2014—the most savage in living memory—ice lingered in Lake Superior well into June. In the worst of that winter, the St. Marys was choked with van-sized bergs and littered with stranded ships, and a trip that in clear water would have taken five hours took her eight days. "Very seldom in a craft this capable do you come up against ice that is your better," Patterson recalled. "It was humbling."

But on this April day, *Katmai Bay* humbled the ice. As we turned north for home, the oil tanker *Algocanada* steamed past heading for a refinery south of Port Huron. Back in Sault Ste. Marie, the Sugar Island ferry was back up and running. The St. Marys River was open to traffic again—until the next slew of ice rode in from Superior, clogging the narrow waters on which the country's steel and grain travel. Then the crew of the *Katmai Bay* would start its engines once more. PM

THE ICE

Ice may just look like ice to the average citizen, but there are big differences for the ice-breaking crew on the Katmai Bay.

BRASH

Broken-up chunks of ice about the size of milk crates.

PLATE

Flat sheets of solid ice floating on still water.

FAST

Ice attached to the lake bottom or shore—it doesn't budge.

GREASE

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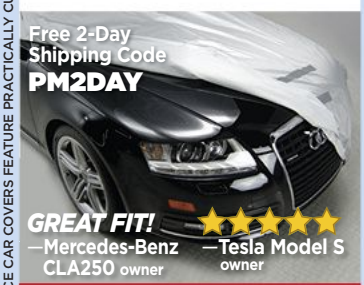

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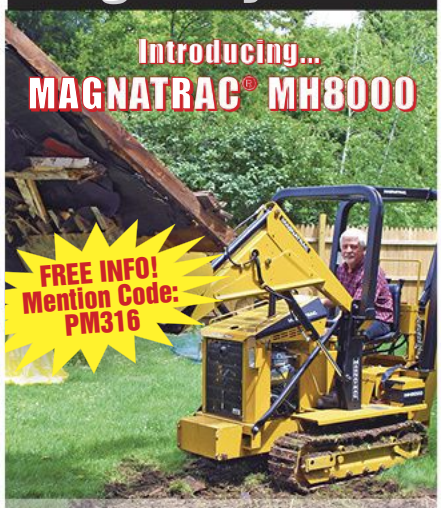

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Stokes, singer and guitarist in the band Dispatch, with his new pride and joy.

THE FAMILY CAR REIMAGINED

A time-challenged dad transforms his old Scion into an homage to classic Land Rovers, testing his nascent DIY skills—and his wife's patience.

BY CHAD STOKES

Fourth of July. My wife and I took our two kids back to my small hometown in Massachusetts to see the parade and go for a fire-truck ride. As we waited in line, volunteer firefighters handed out stickers to the kids. We rode the fire truck. Fun day.

At home, I noticed that one of our kids had stuck a sticker on the driver-side door of my wife's car, a 2006 navy blue Scion xB (the last year Scion made its signature box). I carefully peeled it off…and centered it in the middle of the door. I thought it looked cool.

PHOTOGRAPHS BY PAT PIASECKI

Later my wife stormed in yelling, "Did you see that sticker Frida put on my car?" I raised my eyebrows, pretending to be surprised, and went to remove the sticker. When it finally came off, it left unsightly residue. I tried scraping it off with the ice scraper and ended up scratching the door to a point that was worse than the effect of the sticker.

That's how it started.

I had been wanting to paint my wife's car for a while. Now I had an excuse to at least paint her door a new color and maybe do the passenger-side door to match. She gave me the green light. Here's how it went:

The two doors go easy enough—I choose a reed-green color in an indoor/outdoor X-O Rust professional paint-and-primer-in-one (gloss). The crimes of my haphazard taping yet to be revealed, I'm buoyed by how it looks. However, my wife thinks it looks a little strange to have a dark blue car with two green doors, so I decide to paint the whole car, embarking on the troubled mission with rattling spray cans—outdoors, in the city, in a hurry, and on the cheap. I watch a two-minute video on YouTube—I don't have time for the four-minute one. The video says *only* use Rust-Oleum brand. I run up the street and buy three more cans of reed-green X-O Rust, which the guy says is comparable. I don't know anything about sanding or the careful washing of a car before a paint job, so I don't do it.

Above: One of the author's signature speedy tape-up jobs. Right: With some help, he attempts to master the art of wet sanding. (It will not work.)

I tend to get excitable with this kind of project. I lack what every good painter must have: patience. I don't have the time, I can't spend much money, and I want results. With the kids, who are two and three, finally in bed (we have a strict curfew of 10 p.m.), I quickly tape up the whole car with newspaper and cardboard. I'm running out of tape, so I tape only where I deem it totally necessary. How bad can the overspray be? I get the whole car taped, but now I'm out of paint. Three cans barely touched the other two doors. (It's a four-door.) So now I have a taped-up car with no paint and a wife who needs her car in the morning.

I get up early and clean the hardware store out—three more cans of reed green that are not the same brand. I also grab some almond white for the roof, and more tape. My mission is becoming clearer: I'm going to make this Scion look like a little baby Land Rover. I'm a nut for the early Series II Landies and the old Jeep-y Toyota FJs. (I fell in love with a 1971 Land Rover in Zimbabwe when I lived there as a teenager.) One of the reasons we bought the Scion in the first place was that I liked that its square lines harked back to the old 4x4s. Plus, the two-tone plan helps my cause because I can paint more of the car before my wife leaves for work. I grab as many almond cans as they have

Clockwise from right: Two-foot swaths from ten inches away; after overspray problems, taping became increasingly meticulous; cream-colored wheel wells enhanced the Land Rover aesthetic.

(two). I run back home. Conditions aren't perfect—the wind is fickle and restless. Nevertheless, I quickly empty the cans and then tear off my painstaking tape, cardboard, and newspaper.

Voilà!

Cue the descending muted-trumpet line of universal disappointment. There's overspray pretty much everywhere. The sun sheds fine light on new evidence of my willingness to cut corners. To make matters worse, the other brand's reed green is not the same (and doesn't spray as well). My wife is nonplussed and mutters something about having to go to work in a clown car.

Days pass as I mount my next offensive. I need another coat on there badly. Finally there's a window between kids and work schedules and I run outside, furiously taping again. I'll deal with overspray later. With newfound attention to detail, I carefully tape headlights, sunroof, grille, windows, mirrors. I've stockpiled cans from Lowe's and Home Depot. I've bought more tape. I put toothpicks in the windshield-washer sprayers on the hood, a trick I picked up on YouTube. I assume a wide stance and start spraying: two-foot swaths from ten inches away, depressing the nozzle as my arm is in motion and letting go while *still* in motion with a little flick of the wrist. (Your enemy is overlapping too much so that the paint pools and drips.) I spray like a madman in the dark, jumping around the car in sequential order to let paint dry in one spot while I'm second-coating on another.

I rip off the tape and paper. The car is looking well covered but really streaky. There's paint all over the windows. The whole thing looks like it was painted too quickly, with spray paint that isn't meant for autos, at night. Which it was.

It's now August. My wife is using the car but she's not pleased about it. I'm stealing out when I have the time to fix trouble spots. I hold a piece of cardboard in one hand as a shield and spray with the other so I don't have to retape the whole car—a handy trick, but dicey.

I RIP OFF THE TAPE AND PAPER. THE CAR LOOKS LIKE IT WAS PAINTED TOO QUICKLY, WITH SPRAY PAINT NOT MEANT FOR AUTOS, AT NIGHT. WHICH IT WAS.

I need to fix the painted windows and the streakiness. I consult the Internet. I ask folks at the hardware store. I ask my dad. I ask my neighbor. Someone tells me to hit the windows with steel wool. I get at it, gingerly at first, but soon I'm bearing down with all 165 pounds of myself to get the stubborn paint off. It's working! I go at the windows feverishly, trying to get them cleaned up. My wife just started her career as an interior designer and needs her car to look professional and humorless.

Turns out the wool was the worst thing I could've used. The glass now has tiny circular scratches everywhere. It's a classic case of husbanding: The steel wool scratched the hell out of every window (in the wrong light the windshield is unusable) *and* there's still paint on them. I go back to the Internet and watch the *five*-minute tutorial about how to get paint off car windows. I run to the hardware store and buy a razor-blade scraper. It works like a charm. (If only I had listened to my dad.) The rest of the paint disappears from the windows but there are still little scratches from the steel wool. I try a bunch of compounds to get rid of them, but nothing works.

I move on and order a new bumper on eBay ($70). It's primed black. It shows up and I remove the old cracked bumper, the banged-up detritus from a record-setting Boston winter and snowbanks that lasted into June. The removal is intuitive. Six screws and some plastic push rivets that a flathead screwdriver pops off. I snag the two grilles from the old bumper and paint them with shiny silver interior spray paint. It's the shiniest, most chrome-looking paint the hardware store had, so I optimistically dismiss the "interior only" specification. I also take off the Scion emblem on the front and back—no disrespect to the brand, but I like that it's becoming its own thing. The black bumper looks good.

The car's looking much better. But the streaks! I try wet sanding, the art of going over the whole car with 1,200-grit sandpaper soaked in a bucket of water with a little soap, to even it out. I wet-sand and I wet-sand but I can't tell if it's making a difference. And sometimes I forget to keep it nice and lubed, so I leave tiny scratches on the finish. I tape the car up *again* and try a faint dusting from 15 inches. I put rubbing compound on a Velcro circular bit on my drill and wax on and wax off. The results are far from astounding.

It's getting close to September and my wife is threatening to go buy a new car, which we can't afford. I buy four cans of clear coat and a can of lacquer. I'm pretty sure I don't need the lacquer. I set to taping the car up one last time. I do a loose job because I'm thinking, Hey, it's *clear,* so I can relax on the overspray. The whole point is that it's invisible! This stuff is nasty, a different breed of toxic. I'm feeling bad about my neighbors and the air I'm polluting (and a bit dizzy in

the head). I burn through the four cans in an hour. The car still looks streaky. I take a bath and consult YouTube again about applying clear coat. The dude in the video is going over and over the back bumper of his Accord. First coat is an intentional dusting of long strokes. By the fourth he's overlapping quite a bit, concentrating on a small area at a time. He is really good at it, goes through a handful of cans, and mentions at the end that by the way, a bumper is about as big a surface as you'd ever want to tackle with a rattle can.

When the autumn leaves start changing color, I'm given an ultimatum: I have one more day. Actually, it's not an ultimatum. More like a statement of fact. It's a Saturday. By Monday I have to finish. I need more clear-coat cans and fast.

On the way back from a bachelor party that evening, I convince the party bus to stop at Lowe's, and I run in and clean them out: three cans. (I'm using Rust-Oleum for the clear.) Sunday, my wife wants to stop at Panera. I spy a True Value hardware store across the parking lot. While my wife goes in for sandwiches, I sprint to the store. Five cans—jackpot! Before they can say "Have a nice day" at Panera, I'm back in the car.

Monday morning. I run to my own faithful hardware store and grab all they have, four cans. I now have 12 cans of clear coat, a two- and three-year-old in their car seats, and until sundown to wrap this puppy up. I've secured my mom to look after the kids. On the way out to my folks' house I hit up every hardware store I can find, like a clear-coat junkie. In Roslindale I pull over, grab a kid in each arm, and run in. A nice woman gets out a stepladder and grabs three cans. In Needham I park, run across the street carrying the kids into another store—they're out. I switch over to Routes 9 and 16 and stop in Wellesley. Two more cans.

I find a respirator on my dad's workbench and start spraying. I pull the car halfway into the old horse shed to minimize the wind factor. After a few hours I'm out of paint. It's 4 o'clock. I borrow my mom's car and go to Holliston Hardware for a quick fix, but they don't have the Rust-Oleum I need. (Whatever brand you choose, stick with it.) I speed to Millis and find two hardware stores that have three cans each. I race back home and spray while the light fades. Even though I'm switching hands and alternating between my index and middle fingers, my hands are cramping up. The tip of my right index finger is slightly numb to this day.

My wife arrives at 8. I'm finished because I have to be. Two days later, after the paint has cured, I install a roof rack—critical to the Land Rover look. By a small miracle, the car looks as beautiful as I could've hoped for. The many clear coats helped the paint look less streaky and more uniform. A few weeks later, out on tour with my band, I buy a 1940s grille emblem from a guy named Johnny at a salvage spot near Taos, New Mexico. I snag a Toyota emblem for the back and a V-6 emblem for the side from my mechanic friend Brian at BDR Automotive in Holliston. I believe the first Scions in Japan were Toyotas, so it's not a total fake-out, and it conjures the FJs too. Now I await the last touch, a two-inch lift kit to complete the transformation. Should be coming in the mail from a renegade dude in Arizona. I'll take it to Brian and we'll put her up.

Oh, and as I was driving into Boston the other day, a giant acorn fell from an old oak and shattered the windshield. PM

After the finishing touch—a replica air vent—Stokes's wife finally got her car back.

I AM NOT A RUG

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POPULAR MECHANICS FOR KIDS

TWIG PENCILS

A project to build with your children.

DESIGNED BY JAMES SCHADEWALD

OUR BUILDER: Grace Wilson is an 11-year-old from Pennsylvania.

1

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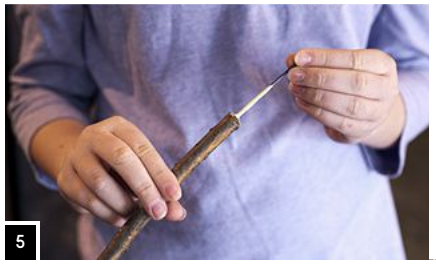


5

6

NOTE

▸ Avoid pine and other conifers, which are often sticky with sap. We found that any hardwood branch will do. If the wood you find is freshly fallen, bring the branch inside and let it dry out for a few days. The glue used to secure the lead works much better on dry wood.

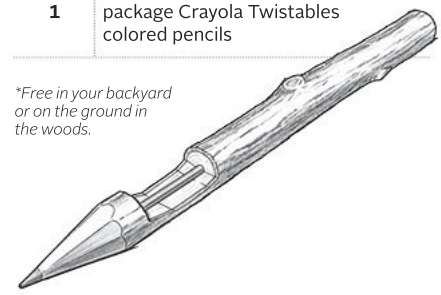
Difficulty: EASY | REASONABLE | HARD

Time: 30 minutes **Ages:** 5+

Shopping List

QTY	DESCRIPTION
4 or 5	small hardwood twigs, at least ¼" in diameter*
1	bottle white or yellow wood glue
1	package Crayola Twistables colored pencils

*Free in your backyard or on the ground in the woods.



Instructions

parent only
parent and kid
kid only

- **1.** After finding a few suitable twigs, use a pruner to trim each to about 6 inches. The dryer the wood, the easier it will be to drill into.
- **2.** Select a drill bit that's a little wider than the pencil lead you plan on using. We used a 3/32-inch twist bit.
- **3.** Clamp the twig to a workbench. Gently pulse the drill to coax the bit into the end grain of the wood. As the bit cuts in, remember to occasionally bring it back out to prevent clogging. After you've drilled the full length of the bit, blow out any wood chips left in the hole.
- **4.** After removing the pencil lead from its housing, put some glue on a piece of scrap wood and roll the lead in it. Cover the length of the lead except for the last inch.
- **5.** Gently insert the glue-covered lead into the twig. You'll have to twist the lead slightly if it's a tight fit. Wait for the glue to dry, then snap off the end of the lead.
- **6.** Hold the branch well away from its writing end and grip a sharp penknife firmly with your thumb at the base of the blade. Use shallow, shaving cuts to create a point.

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INSTRUCTION PHOTOGRAPHS BY REBECCA McALPIN

STUPID or AMAZING

House? Or not a house?

THIS MONTH

TINY HOUSES

STUPID ○ AMAZING

A TINY HOUSE is exactly what you think it is, but if you need a visual aid, just turn on the TV. The cable channels HGTV and FYI, apparently engaged in some sort of tiny arms race, air a total of seven different shows devoted to tiny houses. *Tiny House Nation, Tiny House Hunters, Tiny House Builders…*

The basic idea: An excitable person or couple or family expresses a desire to live in a very small home—usually between a hundred and four hundred square feet and probably on wheels. A home is then built or located by tiny-house experts, and the person, couple, or family proceeds to fawn over its cuteness and ingenuity. A three-in-one couch/bed/desk! A composting toilet! A bedroom with four-foot ceilings! They don't show the part where everyone keeps bumping their head, or where the husband loses it one day because there's no place for the *%$#@! record player, or the kids grow up and never come home to visit because they have to sleep on a dog bed.

It's true that regular houses have become too big. The median size of a new single-family home reached 2,453 square feet in 2014 even as the average family size has decreased. But that's because Americans have worked since the end of World War II to make a high quality of life accessible to as many people as possible. Camp stoves are handy for weekend getaways in the woods, but in this modern age *you can cook on four burners.* There is nothing noble about denying yourself this.

Lots of tiny-house people say they *want* their lives to be one long weekend getaway in the woods—more power to them. Just don't preach about it. Don't shove it in our faces, holier-than-thou, as if you are somehow saving the planet, and we should feel guilty for owning a shower. By the way, many of these twee cottages are sold by companies charging well into the five figures for what are essentially wood-frame camp trailers that can be moved. An aluminum RV would be more energy efficient than burning the gas it takes to tow around the weight of a small home. (Interesting to note: Putting their "homes" on wheels allows tiny housers to skirt building codes and some taxes associated with permanent dwellings.)

The American Dream is nowhere to be found in a wide-open space crowned with a house so small that you can prepare dinner while sitting on the toilet. Last summer, Colorado Springs hosted the first annual National Tiny House Jamboree. Organizers expected ten thousand people, but forty thousand showed up. Some attribute the popularity of the so-called movement to modern ills like the great recession and growing concern about the environment. But in the shadow of Pikes Peak, a famous symbol of westward expansion, you could see a crowd of people pulling their lives around in tiny wooden dwellings for what it really is: an anachronism. PM

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